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(54) Title: LAUNDRY AND CLEANING COMPOSITIONS CONTAINING HEXOSAMINIDASE ENZYMES

(57) Abstract

Laundry or cleaning products comprising one or more hexosaminidase enzymes, and methods for laundering fabrics and cleaning dishes and tableware with aqueous solution containing an effective amount of one or more hexosaminidase enzymes.

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LAUNDRY AND CLEANING COMPOSITIONS CONTAINING HEXOSAMINIDASE ENZYMES

TECHNICAL FIELD

The present invention relates to laundry and cleaning compositions having antimicrobial activity comprising hexosaminidase enzymes.

BACKGROUND OF THE INVENTION

Laundry and cleaning composition having antimicrobial activities are of interest to consumers. Efforts to formulate antimicrobial hand soaps and cleaning compositions are well known. Efforts to produce laundry compositions comprising enzymes having microbial properties are also known, for example, U.S. 5,356,803, issued October 18, 1994 to Carpenter et al.

In spite of such efforts, there continues to be a need for laundry and cleaning compositions having antimicrobial activity. An object of the invention is to provide laundry and cleaning compositions having antimicrobial activity containing hexosaminidase enzymes. These and other objects will be apparent from the detailed description herein.

BACKGROUND ART

US 5,356,803 is directed to the use of Type II endoglycosidases (Endo-D, Endo-H, Endo-F and PNGaseF) in laundry and cleaning compositions. See also: US 5,258,304; US 5,395,541; J. Biol. Chem. (1996), 271 (52), 33425-33432; WO 96/25424; Nat. Struct. Biol. (1996), 3(7), 638-648; Microbiology (1994), 140 (12), 3399-3406; J. Bacteriol. (1994), 176(9), 2640-7; Proc. Nat'l Acad. Sci. USA (1993), 90(14), 6751-5; Proc. Natl. Acad. Sci. USA (1985), 82 (23), 7830-4; and WO 96/36700.

SUMMARY OF THE INVENTION

The present invention relates to laundry or cleaning products comprising one or more hexosaminidase enzymes, preferably at a level of from about 0.001% to about 1%, more preferably from about 0.01% to about 0.5%, by weight of the composition. More preferred are hexosaminidases having minimum inhibitory concentration ("MIC") for antimicrobial activity of less than about 0.125%, most

preferably less than about 0.025%, and/or the ability to remove biofilm. The present invention also relates to a method for laundering fabrics (preferably clothes), said method comprising contacting fabrics in need of cleaning with an aqueous solution containing an effective amount of one or more hexosaminidase enzymes, preferably an aqueous solution of a composition according to the present invention. The present invention further relates to a method for cleaning hard surfaces, such as dishes and tableware, said method comprising contacting the hard surface in need of cleaning with an aqueous solution containing an effective amount of one or more hexosaminidase enzymes, preferably an aqueous solution of a composition according to the present invention, and more preferably for dishes and tableware in an automatic dishwashing machine.

As used herein, the term "hexosaminidase enzyme" means those enzymes whose activity is for the hydrolysis of terminal non-reducing N-acetyl-D-hexosamine residues in N-acetyl-β-D-hexosaminides, thereby acting on N-acetylglucosides and N-acetylgalactosides, and are classified under the class of enzymes EC 3.2.1.52 (also known as "β-N-acetylhexosaminidase"). N-Acetyl-β-D-hexosaminidase is also referred to as "chitobiosidases" or "exochitinase" (see for example, WO 96/36700). Hexosaminidases are known, for example those enzymes having the amino acid SEQ. ID No. 1-5 and 10-11 are classified in the literature as hexosaminidases. Furthermore, DNA sequences encoding for hexosaminidases are known, for example those having the SEQ ID No. 6-9. Examples of such disclosures in the literature include: J. Biol. Chem. (1996), 271 (52), 33425-33432; WO 96/25424; Nat. Struct. Biol. (1996), 3(7), 638-648; Microbiology (1994), 140 (12), 3399-3406; J. Bacteriol. (1994), 176(9), 2640-7; Proc. Nat'l Acad. Sci. USA (1993), 90(14), 6751-5; Proc. Natl. Acad. Sci. USA (1985), 82 (23), 7830-4; and WO 96/36700. In addition, a commercially available hexosaminidase is "exo-β-N-acetylglucosaminidase" sold by Boehringer. Specific N-acetyl-β-D-hexosaminidases from Saccharomyces cerevisiae DSM No. 9944 or DSM 9945 are also described in WO 96/36700.

Thus, more specifically, the invention encompasses laundry and cleaning compositions comprising a hexosaminidase enzyme exhibiting antimicrobial activity, which enzyme:

i) is encoded by a DNA sequence comprising or included in at least one of the sequences of SEQ ID Nos 6-9, or a sequence homologous thereto encoding a hexosaminidase polypeptide,

ii) is immunologically reactive with an antibody raised against a highly purified hexosaminidase encoded by the DNA sequence defined in i), and is specific for hexosaminidase,

iii) is immunologically reactive with an antibody raised against a highly purified hexosaminidase having SEQ ID Nos 1-5, 10 or 11, and is specific for hexosaminidase, or

iv) is a hexosaminidase having SEQ ID Nos 1-5, 10 or 11, or a hexosaminidase polypeptide sequence homologous thereto.

The terms "homologue" and "homologous" as used herein indicate a polypeptide encoded by DNA which hybridizes to the same probe as the DNA coding for an hexosaminidase enzyme under certain specified conditions (such as presoaking in 5xSSC and prehybridizing for 1 h at -40°C in a solution of 5xSSC, 5xDenhardt's solution, and 50 μg of denatured sonicated calf thymus DNA, followed by hybridization in the same solution supplemented with 50 μCi 32-P-dCTP labelled probe for 18 h at -40°C and washing three times in 2xSSC, 0.2% SDS at 40°C for 30 minutes). More specifically, the term is intended to refer to a DNA sequence which is at least 70% homologous to any of SEQ ID Nos 6-9, or the DNA encoding for the hexosaminidases of SEQ ID Nos 1-5, 10 or 11 including at least 75%, at least 80%, at least 85%, at least 90% or even at least 95% with any of these sequences. The term is intended to include modifications of any of such DNA sequences, such as nucleotide substitutions which do not give rise to another amino acid sequence of the polypeptide encoded by the sequence, but which correspond to the codon usage of the host organism into which a DNA construct comprising any of the DNA sequences is introduced or nucleotide substitutions which do give rise to a different amino acid sequence and therefore, possibly, a different amino acid sequence and

therefore, possibly, a different protein structure which might give rise to a hexosaminidase mutant with different properties than the native enzyme. Other examples of possible modifications are insertion of one or more nucleotides into the sequence, addition of one or more nucleotides at either end of the sequence, or deletion of one or more nucleotides at either end or within the sequence.

The term "biofilm" as used herein means irreversibly bound bacteria to a surface.

All parts, percentages and ratios used herein are expressed as percent weight unless otherwise specified. All documents cited are, in relevant part, incorporated herein by reference.

DETAILED DESCRIPTION OF THE INVENTION

Hexosaminidases:

Hexosaminidases have been identified herein as particularly useful for their cleaning and/antimicrobial properties in laundry and cleaning compositions.

A hexosaminidase enzyme useful in the present invention may be isolated by a general method involving:

- cloning, in suitable vectors, a DNA library from a selected species,
- transforming suitable host cells with said vectors,
- culturing the host cells under suitable conditions to express any enzyme of interest encoded by a clone in the DNA library, and
- screening for positive clones by determining any hexosaminidase activity of the enzyme produced by such clones.

The DNA sequence encoding for the desired hexosaminidase enzyme may subsequently be inserted into a recombinant expression vector. This may be any vector which may conveniently be subjected to recombinant DNA procedures, and the choice of vector will often depend on the host cell into which it is to be introduced. Thus, the vector may be an autonomously replicating vector, i.e. a vector which exists as an extrachromosomal entity, the replication of which is independent of chromosomal replication, e.g. a plasmid. Alternatively, the vector may be one which, when introduced into a host cell, is integrated into the host cell

genome and replicated together with the chromosome(s) into which it has been integrated.

In the vector, the DNA sequence encoding the hexosaminidase should be operably connected to a suitable promoter and terminator sequence. The promoter may be any DNA sequence which shows transcriptional activity in the host cell of choice and may be derived from genes encoding proteins either homologous or heterologous to the host cell. The procedures used to ligate the DNA sequences coding for the hexosaminidase, the promoter and the terminator, respectively, and to insert them into suitable vectors are well known to persons skilled in the art (cf., for instance, Sambrook et al., Molecular Cloning. A Laboratory Manual, Cold Spring Harbor, NY 1989).

The host cell which is transformed with the DNA sequence encoding the enzyme useful for the present invention compositions is preferably a eukaryotic cell, in particular a fungal cell such as a yeast or filamentous fungal cell. Fungal cells may be transformed by a process involving protoplast formation and transformation of the protoplasts followed by regeneration of the cell wall in a manner known in the art. The host cell may also be a yeast cell, e.g. a strain of *Saccharomyces*, in particular *Saccharomyces cerevisiae*.

The medium used to culture the transformed host cells may be any conventional medium suitable for growing the host cells in question. The expressed hexosaminidase may conveniently be secreted into the culture medium and may be recovered therefrom by well-known procedures including separating the cells from the medium by centrifugation or filtration, precipitating proteinaceous components of the medium by means of a salt such as ammonium sulphate, followed by chromatographic procedures such as ion exchange chromatography, affinity chromatography, or the like.

The thus purified hexosaminidase may be employed for immunization of animals for the production of antibodies. More specifically, antiserum against the hexosaminidase may be raised by immunizing rabbits (or other rodents) according to the procedure described by N. Axelsen et al. in: A Manual of Quantitative Immunoelectrophoresis, Blackwell Scientific Publications, 1973, Chapter 23, or A.

Johnstone and R. Thorpe, Immunochemistry in Practice, Blackwell Scientific Publications, 1982 (more specifically pp. 27-31). Purified immunoglobulins may be obtained from the antisera, for example by salt precipitation ($(NH_4)_2SO_4$), followed by dialysis and ion exchange chromatography, e.g. on DEAE-Sephadex. Immunochemical characterization of proteins may be done either by Outcherlony double-diffusion analysis (O. Ouchterlony in: Handbook of Experimental Immunology (D.M. Weir, Ed.), Blackwell Scientific Publications, 1967, pp. 655-706), by crossed immunoelectrophoresis (N. Axelsen et al., supra, Chapters 3 and 4), or by rocket immunoelectrophoresis (N. Axelsen et al., Chapter 2).

The enzyme preparation useful in the present invention compositions may be prepared in accordance with methods known in the art and may be in the form of a liquid or a dry preparation. For instance, the enzyme preparation may be in the form of a granulate or a microgranulate. The enzyme to be included in the preparation may also be stabilized in accordance with methods known in the art.

The enzyme preparation useful in the present compositions may, in addition to a hexosaminidase, contain one or more other detergent enzymes and/or other plant cell wall degrading enzymes, for instance those with cellulytic, xylanolytic or pectinolytic activities such as xylanase, arabinanase, rhamnogalacturonase, pectin acetylesterase, galactanase, polygalacturonase, pectin lyase, pectate lyase, endo-glucanase or pectin methylesterase. The additional enzyme(s) may be producible by means of a microorganism belonging to the genus *Aspergillus*, preferably *aspergillus niger, Aspergillus aculeatus, Aspergillus awamoi* or *Aspergillus oryzae*.

Test Methods:

The potency of antimicrobial activity of the hexosaminidase useful herein is measured by determining the minimum inhibitory concentration (MIC) of enzyme required to inhibit growth of bacteria/fungi. For example, the bacteria used can include Escherichia coli 25922, 11229, Staphylococcus aureaus 25932,6538, Psudomonas aeruginosa 27853 and Proteus mirabilis 12453.

The minimum inhibitory concentration of enzyme to inhibit growth of bacteria is determined in Robbins Scientific 96 well microassay Microplates with 50 µl wells. 105 µl of stock solutions of the single bacteria (from ATCC) are diluted in

15 ml of growth medium based on Tryptic Soy Broth/Agar (Carr-Scarrborough). The enzyme samples are diluted to 8000 ppm active enzyme in buffer solution. 10 µl of buffer is added to each well. 10 µl of enzyme solution is added in the first well. The enzyme solution is diluted in subsequent wells by 50%, by sequential transfer of 10 µl. After final dilution 10 µl of bacteria with growth medium is added to each well. All manipulations are performed with sterile material. All plates are incubated at 37°C for 12-24 hours. The growth of bacteria is assessed under a microscope. The minimum inhibitory concentration is determined by the lowest enzyme concentration which does not show bacteria growth. Preferred hexosaminidases for use herein have antimicrobial activity of less than about 0.125%.

Scanning electron microscopy can be used to determine biofilm removal. Preferred hexosaminidases for use herein have the ability to remove biofilm.

Cleaning Composition Ingredients and Detergent Compositions

The detergent compositions of the invention contain laundry or cleaning composition ingredients as described hereinafter. The precise nature of these components, and levels of incorporation thereof will depend on the physical form of the composition, and the nature of the cleaning operation for which it is to be used.

The detergent compositions according to the invention can be liquid, paste, gels, bars, tablets, powder or granular forms. Granular compositions can also be in "compact" form, the liquid compositions can also be in a "concentrated" form.

The compositions of the invention may for example, be formulated as hand and machine laundry detergent compositions including laundry additive compositions and compositions suitable for use in the soaking and/or pretreatment of stained fabrics, rinse added fabric softener compositions. Pre-or post treatment of fabric include gel, spray and liquid fabric conditioning compositions.

When formulated as compositions suitable for use in a laundry machine washing method, the compositions of the invention preferably contain both a surfactant and a builder compound and additionally one or more detergent components preferably selected from organic polymeric compounds, bleaching agents, additional enzymes, suds suppressors, dispersants, lime-soap dispersants, soil

suspension and anti-redeposition agents and corrosion inhibitors. Laundry compositions can also contain softening agents, as additional detergent components.

The compositions of the invention can also be used as detergent additive products. Such additive products are intended to supplement or boost the performance of conventional detergent compositions.

If needed the density of the laundry detergent compositions herein ranges from 400 to 1200 g/litre, preferably 600 to 950 g/litre of composition measured at 20°C.

The "compact" form of the compositions herein is best reflected by density and, in terms of composition, by the amount of inorganic filler salt; inorganic filler salts are conventional ingredients of detergent compositions in powder form; in conventional detergent compositions, the filler salts are present in substantial amounts, typically 17-35% by weight of the total composition.

In the compact compositions, the filler salt is present in amounts not exceeding 15% of the total composition, preferably not exceeding 10%, most preferably not exceeding 5% by weight of the composition.

The inorganic filler salts, such as meant in the present compositions are selected from the alkali and alkaline-earth-metal salts of sulphates and chlorides. A preferred filler salt is sodium sulphate.

Liquid detergent compositions according to the present invention can also be in a "concentrated form", in such case, the liquid detergent compositions according the present invention will contain a lower amount of water, compared to conventional liquid detergents.

Typically the water content of the concentrated liquid detergent is preferably less than 40%, more preferably less than 30%, most preferably less than 20% by weight of the detergent composition.

Surfactants

Preferably, the detergent compositions according to the present invention comprise a surfactant or surfactant system wherein the surfactant can be selected from nonionic and/or anionic and/or cationic and/or ampholytic and/or zwitterionic and/or semi-polar nonionic surfactants.

The surfactant is typically present at a level of from 0.1% to 60% by weight. More preferred levels of incorporation are 1% to 35% by weight, most preferably from 1% to 30% by weight of detergent compositions in accord with the invention.

The surfactant is preferably formulated to be compatible with enzyme components present in the composition. In liquid or gel compositions the surfactant is most preferably formulated such that it promotes, or at least does not degrade, the stability of any enzyme in these compositions.

Examples of suitable nonionic, anionic, cationic, ampholytic, zwitterionic and semi-polar nonionic surfactants are disclosed in U.S. Patent Nos. 5,707,950 and 5,576,282.

Highly preferred nonionic surfactants are polyhydroxy fatty acid amide surfactants of the formula:

$R^2 - C(O) - N(R^1) - Z$,

wherein R^1 is H, or R^1 is C_{1-4} hydrocarbyl, 2-hydroxy ethyl, 2-hydroxy propyl or a mixture thereof, R^2 is C_{5-31} hydrocarbyl, and Z is a polyhydroxyhydrocarbyl having a linear hydrocarbyl chain with at least 3 hydroxyls directly connected to the chain, or an alkoxylated derivative thereof. Preferably, R^1 is methyl, R^2 is a straight C_{11-15} alkyl or C_{16-18} alkyl or alkenyl chain such as coconut alkyl or mixtures thereof, and Z is derived from a reducing sugar such as glucose, fructose, maltose, lactose, in a reductive amination reaction.

Highly preferred anionic surfactants include alkyl alkoxylated sulfate surfactants hereof are water soluble salts or acids of the formula $RO(A)_mSO3M$ wherein R is an unsubstituted C_{10}-C_{24} alkyl or hydroxyalkyl group having a C_{10}-C_{24} alkyl component, preferably a C_{12}-C_{20} alkyl or hydroxyalkyl, more preferably C_{12}-C_{18} alkyl or hydroxyalkyl, A is an ethoxy or propoxy unit, m is greater than zero, typically between about 0.5 and about 6, more preferably between about 0.5 and about 3, and M is H or a cation which can be, for example, a metal cation (e.g., sodium, potassium, lithium, calcium, magnesium, etc.), ammonium or substituted-ammonium cation. Alkyl ethoxylated sulfates as well as alkyl propoxylated sulfates are contemplated herein.

When included therein, the laundry detergent compositions of the present invention typically comprise from about 1% to about 40%, preferably from about 3% to about 20% by weight of such anionic surfactants.

Highly preferred cationic surfactants are the water-soluble quaternary ammonium compounds useful in the present composition having the formula :

$$R_1R_2R_3R_4N^+X^-$$

wherein R_1 is C_8-C_{16} alkyl, each of R_2, R_3 and R_4 is independently C_1-C_4 alkyl, C_1-C_4 hydroxy alkyl, benzyl, and $-(C_2H_{40})_xH$ where x has a value from 2 to 5, and X is an anion. Not more than one of R_2, R_3 or R_4 should be benzyl.

When included therein, the detergent compositions of the present invention typically comprise from 0.2% to about 25%, preferably from about 1% to about 8% by weight of such cationic surfactants.

When included therein, the detergent compositions of the present invention typically comprise from 0.2% to about 15%, preferably from about 1% to about 10% by weight of such ampholytic surfactants.

When included therein, the detergent compositions of the present invention typically comprise from 0.2% to about 15%, preferably from about 1% to about 10% by weight of such zwitterionic surfactants.

When included therein, the detergent compositions of the present invention typically comprise from 0.2% to about 15%, preferably from about 1% to about 10% by weight of such semi-polar nonionic surfactants.

The detergent composition of the present invention may further comprise a cosurfactant selected from the group of primary or tertiary amines.

Suitable primary amines for use herein include amines according to the formula R_1NH_2 wherein R_1 is a C_6-C_{12}, preferably C_6-C_{10} alkyl chain or $R_4X(CH_2)_n$, X is -O-, -C(O)NH- or -NH-, R_4 is a C_6-C_{12} alkyl chain n is between 1 to 5, preferably 3. R_1 alkyl chains may be straight or branched and may be interrupted with up to 12, preferably less than 5 ethylene oxide moieties.

Preferred amines according to the formula herein above are n-alkyl amines. Suitable amines for use herein may be selected from 1-hexylamine, 1-octylamine, 1-decylamine and laurylamine. Other preferred primary amines include C8-C10

oxypropylamine, octyloxypropylamine, 2-ethylhexyl-oxypropylamine, lauryl amido propylamine and amido propylamine.

Suitable tertiary amines for use herein include tertiary amines having the formula $R_1R_2R_3N$ wherein R1 and R2 are C_1-C_8 alkylchains or

$$-\left(CH_2-\underset{R_5}{CH}-O\right)_xH$$

R_3 is either a C_6-C_{12}, preferably C_6-C_{10} alkyl chain, or R_3 is $R_4X(CH_2)_n$, whereby X is -O-, -C(O)NH- or -NH-, R_4 is a C_4-C_{12}, n is between 1 to 5, preferably 2-3. R_5 is H or C_1-C_2 alkyl and x is between 1 to 6 .

R_3 and R_4 may be linear or branched ; R_3 alkyl chains may be interrupted with up to 12, preferably less than 5, ethylene oxide moieties.

Preferred tertiary amines are $R_1R_2R_3N$ where R1 is a C6-C12 alkyl chain, R2 and R3 are C1-C3 alkyl or

$$-\left(CH_2-\underset{R_5}{CH}-O\right)_xH$$

where R5 is H or CH3 and x = 1-2.

Also preferred are the amidoamines of the formula:

$$R_1-\overset{O}{\overset{\|}{C}}-NH-(CH_2)_n-N-(R_2)_2$$

wherein R_1 is C_6-C_{12} alkyl; n is 2-4,

preferably n is 3; R_2 and R_3 is C_1-C_4

Most preferred amines of the present invention include 1-octylamine, 1-hexylamine, 1-decylamine, 1-dodecylamine,C8-10oxypropylamine, N coco 1-3diaminopropane, coconutalkyldimethylamine, lauryldimethylamine, lauryl bis(hydroxyethyl)amine, coco bis(hydroxyehtyl)amine, lauryl amine 2 moles propoxylated, octyl amine 2 moles propoxylated, lauryl amidopropyldimethylamine, C8-10 amidopropyldimethylamine and C10 amidopropyldimethylamine.

The most preferred amines for use in the compositions herein are 1-hexylamine, 1-octylamine, 1-decylamine, 1-dodecylamine. Especially desirable are n-dodecyldimethylamine and bishydroxyethylcoconutalkylamine and oleylamine 7

times ethoxylated, lauryl amido propylamine and cocoamido propylamine.

The surfactant and surfactant system of the present invention is preferably formulated to be compatible with enzyme components present in the composition. In liquid or gel compositions the surfactant is most preferably formulated such that it promotes, or at least does not degrade, the stability of any enzyme in these compositions.

Builders

The compositions according to the present invention may further comprise a builder or builder system. Any conventional builder system is suitable for use herein including aluminosilicate materials, silicates, polycarboxylates, alkyl- or alkenyl-succinic acid and fatty acids, materials such as ethylenediamine tetraacetate, diethylene triamine pentamethyleneacetate, metal ion sequestrants such as aminopolyphosphonates, particularly ethylenediamine tetramethylene phosphonic acid and diethylene triamine pentamethylenephosphonic acid. Phosphate builders can also be used herein.

The present invention may include a suitable builder or detergency salt. The level of detergent salt/builder can vary widely depending upon the end use of the composition and its desired physical form. When present, the compositions will typically comprise at least about 1% builder and more typically from about 10% to about 80%, even more typically from about 15% to about 50% by weight, of the builder. Lower or higher levels, however, are not meant to be excluded.

Inorganic or P-containing detergent salts include, but are not limited to, the alkali metal, ammonium and alkanolammonium salts of polyphosphates (exemplified by the tripolyphosphates, pyrophosphates, and glassy polymeric meta-phosphates), phosphonates, phytic acid, silicates, carbonates (including bicarbonates and sesquicarbonates), sulphates, and aluminosilicates. However, non-phosphate salts are required in some locales. Importantly, the compositions herein function surprisingly well even in the presence of the so-called "weak" builders (as compared with phosphates) such as citrate, or in the so-called "underbuilt" situation that may occur with zeolite or layered silicate builders.

Organic detergent builders suitable for the purposes of the present invention

include, but are not restricted to, a wide variety of polycarboxylate compounds. As used herein, "polycarboxylate" refers to compounds having a plurality of carboxylate groups, preferably at least 3 carboxylates. Polycarboxylate builder can generally be added to the composition in acid form, but can also be added in the form of a neutralized salt. When utilized in salt form, alkali metals, such as sodium, potassium, and lithium, or alkanolammonium salts are preferred.

Examples of suitable silicate builders, carbonate salts, aluminosilicate builders, polycarboxylate builders, citrate builders, 3,3-dicarboxy-4-oxa-1,6-hexanedioate builders and related compounds disclosed in U.S. Patent No. 4,566,984, to Bush, succinic acid builders, phosphorous-based builders and fatty acids, are disclosed in U.S. Patent Nos. 5,576,282, 5,728,671 and 5,707,950.

Additional suitable builders can be an inorganic ion exchange material, commonly an inorganic hydrated aluminosilicate material, more particularly a hydrated synthetic zeolite such as hydrated zeolite A, X, B, HS or MAP.

Specific polycarboxylates suitable for the present invention are polycarboxylates containing one carboxy group include lactic acid, glycolic acid and ether derivatives thereof as disclosed in Belgian Patent Nos. 831,368, 821,369 and 821,370. Polycarboxylates containing two carboxy groups include the water-soluble salts of succinic acid, malonic acid, (ethylenedioxy) diacetic acid, maleic acid, diglycollic acid, tartaric acid, tartronic acid and fumaric acid, as well as the ether carboxylates described in German Offenlegenschrift 2,446,686, and 2,446,687 and U.S. Patent No. 3,935,257 and the sulfinyl carboxylates described in Belgian Patent No. 840,623. Polycarboxylates containing three carboxy groups include, in particular, water-soluble citrates, aconitrates and citraconates as well as succinate derivatives such as the carboxymethyloxysuccinates described in British Patent No. 1,379,241, lactoxysuccinates described in Netherlands Application 7205873, and the oxypolycarboxylate materials such as 2-oxa-1,1,3-propane tricarboxylates described in British Patent No. 1,387,447.

Polycarboxylates containing four carboxy groups include oxydisuccinates disclosed in British Patent No. 1,261,829, 1,1,2,2-ethane tetracarboxylates, 1,1,3,3-propane tetracarboxylates and 1,1,2,3-propane tetracarboxylates. Polycarboxylates

containing sulfo substituents include the sulfosuccinate derivatives disclosed in British Patent Nos. 1,398,421 and 1,398,422 and in U.S. Patent No. 3,936,448, and the sulfonated pyrolysed citrates described in British Patent No. 1,082,179, while polycarboxylates containing phosphone substituents are disclosed in British Patent No. 1,439,000.

Alicyclic and heterocyclic polycarboxylates include cyclopentane-cis,cis,cis-tetracarboxylates, cyclopentadienide pentacarboxylates, 2,3,4,5-tetrahydro-furan - cis, cis, cis-tetracarboxylates, 2,5-tetrahydro-furan -cis - dicarboxylates, 2,2,5,5-tetrahydrofuran - tetracarboxylates, 1,2,3,4,5,6-hexane -hexacar-boxylates and and carboxymethyl derivatives of polyhydric alcohols such as sorbitol, mannitol and xylitol. Aromatic poly-carboxylates include mellitic acid, pyromellitic acid and the phthalic acid derivatives disclosed in British Patent No. 1,425,343.

Of the above, the preferred polycarboxylates are hydroxycarboxylates containing up to three carboxy groups per molecule, more particularly citrates.

Preferred builder systems for use in the present compositions include a mixture of a water-insoluble aluminosilicate builder such as zeolite A or of a layered silicate (SKS-6), and a water-soluble carboxylate chelating agent such as citric acid.

Preferred builder systems include a mixture of a water-insoluble aluminosilicate builder such as zeolite A, and a watersoluble carboxylate chelating agent such as citric acid. Preferred builder systems for use in liquid detergent compositions of the present invention are soaps and polycarboxylates.

Other suitable water-soluble organic salts are the homo- or co-polymeric acids or their salts, in which the polycarboxylic acid comprises at least two carboxyl radicals separated from each other by not more than two carbon atoms. Polymers of this type are disclosed in GB-A-1,596,756. Examples of such salts are polyacrylates of MW 2000-5000 and their copolymers with maleic anhydride, such copolymers having a molecular weight of from 20,000 to 70,000, especially about 40,000.

Detergency builder salts are normally included in amounts of from 5% to 80% by weight of the composition preferably from 10% to 70% and most usually from 30% to 60% by weight.

Bleaching agent

Additional optional detergent ingredients that can be included in the detergent compositions of the present invention include bleaching agents such as hydrogen peroxide, PB1, PB4 and percarbonate with a particle size of 400-800 microns. These bleaching agent components can include one or more oxygen bleaching agents and, depending upon the bleaching agent chosen, one or more bleach activators. When present oxygen bleaching compounds will typically be present at levels of from about 1% to about 25%.

The bleaching agent component for use herein can be any of the bleaching agents useful for detergent compositions including oxygen bleaches as well as others known in the art. The bleaching agent suitable for the present invention can be an activated or non-activated bleaching agent.

Examples of suitable bleaching agents are disclosed in U.S. Patent Nos. 5,707,950 and 5,576,282.

The hydrogen peroxide releasing agents can be used in combination with, for example, the bleach activators disclosed in U.S. Patent No. 5,707,950 or Phenolsulfonate ester of N-nonanoyl-6-aminocaproic acid (NACA-OBS, described in WO94/28106), which are perhydrolyzed to form a peracid as the active bleaching species, leading to improved bleaching effect. Also suitable activators are acylated citrate esters.

Useful bleaching agents, including peroxyacids and bleaching systems comprising bleach activators and peroxygen bleaching compounds for use in detergent compositions according to the invention are described in WO95/27772, WO95/27773, WO95/27774, WO95/27775 and U.S. Patent No. 5,707,950.

Metal-containing catalysts for use in bleach compositions, include cobalt-containing catalysts such as Pentaamine acetate cobalt(III) salts and manganese-containing catalysts such as those described in EPA 549 271; EPA 549 272; EPA 458 397; US 5,246,621; EPA 458 398; US 5,194,416 and US 5,114,611. Bleaching composition comprising a peroxy compound, a manganese-containing bleach catalyst and a chelating agent is described in the patent application No 94870206.3.

Dye transfer inhibition

The detergent compositions of the present invention can also include

compounds for inhibiting dye transfer from one fabric to another of solubilized and suspended dyes encountered during fabric laundering and conditioning operations involving colored fabrics.

Polymeric dye transfer inhibiting agents

The detergent compositions according to the present invention can also comprise from 0.001% to 10 %, preferably from 0.01% to 2%, more preferably from 0.05% to 1% by weight of polymeric dye transfer inhibiting agents. Said polymeric dye transfer inhibiting agents are normally incorporated into detergentcompositions in order to inhibit the transfer of dyes from colored fabrics onto fabrics washed therewith. These polymers have the ability to complex or adsorb the fugitive dyes washed out of dyed fabrics before the dyes have the opportunity to become attached to other articles in the wash.

Especially suitable polymeric dye transfer inhibiting agents are polyamine N-oxide polymers, copolymers of N-vinylpyrrolidone and N-vinylimidazole, polyvinylpyrrolidone polymers, polyvinyloxazolidones and polyvinylimidazoles or mixtures thereof. Examples of such dye transfer inhibiting agents are disclosed in U.S. Patent Nos. 5,707,950 and 5,707,951.

Additional suitable dye transfer inhibiting agents include, but are not limited to, cross-linked polymers. Cross-linked polymers are polymers whose backbone are interconnected to a certain degree; these links can be of chemical or physical nature, possibly with active groups n the backbone or on branches; cross-linked polymers have been described in the Journal of Polymer Science, volume 22, pages 1035-1039.

In one embodiment, the cross-linked polymers are made in such a way that they form a three-dimensional rigid structure, which can entrap dyes in the pores formed by the three-dimensional structure. In another embodiment, the cross-linked polymers entrap the dyes by swelling.

Such cross-linked polymers are described in the co-pending European patent application 94870213.9

Addition of such polymers also enhances the performance of the enzymes according the invention.

Dispersants

The detergent composition of the present invention can also contain dispersants. Suitable water-soluble organic salts are the homo- or co-polymeric acids or their salts, in which the polycarboxylic acid comprises at least two carboxyl radicals separated from each other by not more than two carbon atoms.

Polymers of this type are disclosed in GB-A-1,596,756. Examples of such salts are polyacrylates of MW 2000-5000 and their copolymers with maleic anhydride, such copolymers having a molecular weight of from 1,000 to 100,000.

Especially, copolymer of acrylate and methylacrylate such as the 480N having a molecular weight of 4000, at a level from 0.5-20% by weight of composition can be added in the detergentcompositions of the present invention.

The compositions of the invention may contain a lime soap peptiser compound, which has a lime soap dispersing power (LSDP), as defined hereinafter of no more than 8, preferably no more than 7, most preferably no more than 6. The lime soap peptiser compound is preferably present at a level from 0% to 20% by weight.

A numerical measure of the effectiveness of a lime soap peptiser is given by the lime soap dispersant power (LSDP) which is determined using the lime soap dispersant test as described in an article by H.C. Borghetty and C.A. Bergman, J. Am. Oil. Chem. Soc., volume 27, pages 88-90, (1950). This lime soap dispersion test method is widely used by practitioners in this art field being referred to, for example, in the following review articles; W.N. Linfield, Surfactant science Series, Volume 7, page 3; W.N. Linfield, Tenside surf. det., volume 27, pages 159-163, (1990); and M.K. Nagarajan, W.F. Masler, Cosmetics and Toiletries, volume 104, pages 71-73, (1989). The LSDP is the % weight ratio of dispersing agent to sodium oleate required to disperse the lime soap deposits formed by 0.025g of sodium oleate in 30ml of water of 333ppm $CaCo_3$ (Ca:Mg=3:2) equivalent hardness.

Surfactants having good lime soap peptiser capability will include certain amine oxides, betaines, sulfobetaines, alkyl ethoxysulfates and ethoxylated alcohols.

Exemplary surfactants having a LSDP of no more than 8 for use in accord with the present invention include C_{16}-C_{18} dimethyl amine oxide, C_{12}-C_{18} alkyl

ethoxysulfates with an average degree of ethoxylation of from 1-5, particularly C_{12}-C_{15} alkyl ethoxysulfate surfactant with a degree of ethoxylation of amount 3 (LSDP=4), and the C_{14}-C_{15} ethoxylated alcohols with an average degree of ethoxylation of either 12 (LSDP=6) or 30, sold under the tradenames Lutensol A012 and Lutensol A030 respectively, by BASF GmbH.

Polymeric lime soap peptisers suitable for use herein are described in the article by M.K. Nagarajan, W.F. Masler, to be found in Cosmetics and Toiletries, volume 104, pages 71-73, (1989).

Hydrophobic bleaches such as 4-[N-octanoyl-6-aminohexanoyl]benzene sulfonate, 4-[N-nonanoyl-6-aminohexanoyl]benzene sulfonate, 4-[N-decanoyl-6-aminohexanoyl]benzene sulfonate and mixtures thereof; and nonanoyloxy benzene sulfonate together with hydrophilic / hydrophobic bleach formulations can also be used as lime soap peptisers compounds.

Examples of other suitable dispersing agents are disclosed in U.S. Patent Nos. 5,576,282 and 5,728,671.

Conventional detergent enzymes

The detergent compositions can comprise in addition to the hexosaminidase enzyme one or more enzymes which provide cleaning performance and/or fabric care benefits.

Said enzymes include enzymes selected from hemicellulases, peroxidases, proteases, cellulases, xylanases, lipases, phospholipases, esterases, cutinases, pectinases, keratanases, reductases, oxidases, phenoloxidases, lipoxygenases, ligninases, pullulanases, tannases, pentosanases, malanases, ß-glucanases, arabinosidases, hyaluronidase, chondroitinase, laccase, and known amylases, or mixtures thereof.

Examples of suitable enzymes are disclosed in U.S. Patent Nos. 5,576,282, 5,728,671 and 5,707,950

A preferred combination is a detergent composition having cocktail of conventional applicable enzymes like protease, lipase, cutinase and/or cellulase in conjunction with the hexosaminidase.

Particularly useful proteases are described in PCT publications: WO

95/30010 published November 9, 1995 by The Procter & Gamble Company; WO 95/30011 published November 9, 1995 by The Procter & Gamble Company; and WO 95/29979 published November 9, 1995 by The Procter & Gamble Company.

In addition to the peroxidase enzymes disclosed in U.S. Patent Nos. 5,576,282, 5,728,671 and 5,707,950, other suitable peroxidase enzymes are disclosed in European Patent application EP No. 96870013.8, filed February 20, 1996. Also suitable is the laccase enzyme.

Preferred enhancers are substitued phenthiazine and phenoxasine 10-Phenothiazinepropionicacid (PPT), 10-ethylphenothiazine-4-carboxylic acid (EPC), 10-phenoxazinepropionic acid (POP) and 10-methylphenoxazine (described in WO 94/12621) and substitued syringates (C3-C5 substitued alkyl syringates) and phenols. Sodium percarbonate or perborate are preferred sources of hydrogen peroxide.

Said peroxidases are normally incorporated in the detergent composition at levels from 0.0001% to 2% of active enzyme by weight of the detergent composition.

Other preferred enzymes that can be included in the detergent compositions of the present invention include lipases. Suitable lipase enzymes for detergent usage include those produced by microorganisms of the Pseudomonas group, such as Pseudomonas stutzeri ATCC 19.154, as disclosed in British Patent 1,372,034. Suitable lipases include those which show a positive immunological cross-reaction with the antibody of the lipase, produced by the microorganism *Pseudomonas fluorescent* IAM 1057. This lipase is available from Amano Pharmaceutical Co. Ltd., Nagoya, Japan, under the trade name Lipase P "Amano," hereinafter referred to as "Amano-P". Other suitable commercial lipases include Amano-CES, lipases ex *Chromobacter viscosum*, e.g. *Chromobacter viscosum var. lipolyticum* NRRLB 3673 from Toyo Jozo Co., Tagata, Japan; *Chromobacter viscosum* lipases from U.S. Biochemical Corp., U.S.A. and Disoynth Co., The Netherlands, and lipases ex *Pseudomonas gladioli*. Especially suitable lipases are lipases such as M1 Lipase^{R} and Lipomax^{R} (Gist-Brocades) and Lipolase^{R} and Lipolase Ultra^{R}(Novo) which have found to be very effective when used in combination with the compositions of

the present invention.

Also suitable are cutinases [EC 3.1.1.50] which can be considered as a special kind of lipase, namely lipases which do not require interfacial activation. Addition of cutinases to detergent compositions have been described in e.g. WO 88/09367 (Genencor).

The lipases and/or cutinases are normally incorporated in the detergent composition at levels from 0.0001% to 2% of active enzyme by weight of the detergent composition.

Known amylases (α and/or ß) can be included for removal of carbohydrate-based stains. WO 94/02597, Novo Nordisk A/S published February 03, 1994, describes cleaning compositions which incorporate mutant amylases. See also WO94/18314, Genencor, published August 18, 1994 and WO95/10603, Novo Nordisk A/S, published April 20, 1995. Other amylases known for use in detergent compositions include both α- and β-amylases. α-Amylases are known in the art and include those disclosed in US Pat. 5,003,257; EP 252,666; WO 91/00353; FR 2,676,456; EP 285,123; EP 525,610; EP 368,341; and British Patent Specification No. 1,296,839 (Novo). Other suitable amylase are stability-enhanced amylases including Purafact Ox Am^R described in WO 94/18314, published August 18, 1994 and WO96/05295, Genencor, published Februaury 22, 1996 and amylase variants from Novo Nordisk A/S, disclosed in WO 95/10603, published April 95.

Examples of commercial α-amylases products are Termamyl®, Ban®, Fungamyl® and Duramyl®, all available from Novo Nordisk A/S Denmark. WO95/26397 describes other suitable amylases : α-amylases characterised by having a specific activity at least 25% higher than the specific activity of Termamyl ® at a temperature range of 25°C to 55°C and at a pH value in the range of 8 to 10, measured by the Phadebas® α-amylase activity assay. Other amylolytic enzymes with improved properties with respect to the activity level and the combination of thermostability and a higher activity level are described in WO95/35382.

The above-mentioned enzymes may be of any suitable origin, such as vegetable, animal, bacterial, fungal and yeast origin. Purified or non-purified forms of these enzymes may be used. Also included by definition, are mutants of native

enzymes. Mutants can be obtained e.g. by protein and/or genetic engineering, chemical and/or physical modifications of native enzymes. Common practice as well is the expression of the enzyme via host organisms in which the genetic material responsible for the production of the enzyme has been cloned.

Said enzymes are normally incorporated in the detergent composition at levels from 0.0001% to 2% of active enzyme by weight of the detergent composition. The enzymes can be added as separate single ingredients (prills, granulates, stabilized liquids, etc. containing one enzyme) or as mixtures of two or more enzymes (e.g. cogranulates).

Other suitable detergent ingredients that can be added are enzyme oxidation scavengers. Examples of such enzyme oxidation scavengers are ethoxylated tetraethylene polyamines.

A range of enzyme materials and means for their incorporation into synthetic detergent compositions is also disclosed in WO 9307263 and WO 9307260 to Genencor International, WO 8908694 to Novo, and U.S. 3,553,139, January 5, 1971 to McCarty et al. Enzymes are further disclosed in U.S. 4,101,457, Place et al, July 18, 1978, and in U.S. 4,507,219, Hughes, March 26, 1985. Enzyme materials useful for liquid detergent formulations, and their incorporation into such formulations, are disclosed in U.S. 4,261,868, Hora et al, April 14, 1981. Enzymes for use in detergents can be stabilized by various techniques. Enzyme stabilisation techniques are disclosed and exemplified in U.S. 3,600,319, August 17, 1971, Gedge et al, EP 199,405 and EP 200,586, October 29, 1986, Venegas. Enzyme stabilisation systems are also described, for example, in U.S. 3,519,570. A useful Bacillus, sp. AC13 giving proteases, xylanases and cellulases, is described in WO 9401532 to Novo.

Chelating Agents

The detergent compositions herein may also optionally contain one or more iron and/or manganese chelating agents. Such chelating agents can be selected from the group consisting of amino carboxylates, amino phosphonates, polyfunctionally-substituted aromatic chelating agents and mixtures therein, all as hereinafter defined. Without intending to be bound by theory, it is believed that the benefit of these materials is due in part to their exceptional ability to remove iron and manganese

ions from washing solutions by formation of soluble chelates.

Examples of suitable chelating agents are disclosed in U.S. Patent No. 5,728,671.

The compositions herein may also contain water-soluble methyl glycine diacetic acid (MGDA) salts (or acid form) as a chelant or co-builder useful with, for example, insoluble builders such as zeolites, layered silicates and the like.

If utilized, these chelating agents will generally comprise from about 0.1% to about 15% by weight of the detergent compositions herein. More preferably, if utilized, the chelating agents will comprise from about 0.1% to about 3.0% by weight of such compositions.

Suds suppressor

Another optional ingredient is a suds suppressor, exemplified by silicones, and silica-silicone mixtures. Examples of suitable suds suppressors are disclosed in U.S. Patent Nos. 5,707,950 and 5,728,671. These suds suppressors are normally employed at levels of from 0.001% to 2% by weight of the composition, preferably from 0.01% to 1% by weight.

Softening agents

Fabric softening agents can also be incorporated into laundry detergent compositions in accordance with the present invention. These agents may be inorganic or organic in type. Inorganic softening agents are exemplified by the smectite clays disclosed in GB-A-1 400 898 and in USP 5,019,292. Organic fabric softening agents include the water insoluble tertiary amines as disclosed in GB-A1 514 276 and EP-B0 011 340 and their combination with mono C12-C14 quaternary ammonium salts are disclosed in EP-B-0 026 527 and EP-B-0 026 528 and di-long-chain amides as disclosed in EP-B-0 242 919. Other useful organic ingredients of fabric softening systems include high molecular weight polyethylene oxide materials as disclosed in EP-A-0 299 575 and 0 313 146.

Particularly suitable fabric softening agents are disclosed in U.S. Patent Nos. 5,707,950 and 5,728,673.

Levels of smectite clay are normally in the range from 2% to 20%, more preferably from 5% to 15% by weight, with the material being added as a dry mixed

component to the remainder of the formulation. Organic fabric softening agents such as the water-insoluble tertiary amines or dilong chain amide materials are incorporated at levels of from 0.5% to 5% by weight, normally from 1% to 3% by weight whilst the high molecular weight polyethylene oxide materials and the water soluble cationic materials are added at levels of from 0.1% to 2%, normally from 0.15% to 1.5% by weight. These materials are normally added to the spray dried portion of the composition, although in some instances it may be more convenient to add them as a dry mixed particulate, or spray them as molten liquid on to other solid components of the composition.

Typical cationic fabric softening components include the water-insoluble quaternary-ammonium fabric softening actives, the most commonly used having been di-long alkyl chain ammonium chloride or methyl sulfate.

Preferred cationic softeners among these include the following:

1) ditallow dimethylammonium chloride (DTDMAC);
2) dihydrogenated tallow dimethylammonium chloride;
3) dihydrogenated tallow dimethylammonium methylsulfate;
4) distearyl dimethylammonium chloride;
5) dioleyl dimethylammonium chloride;
6) dipalmityl hydroxyethyl methylammonium chloride;
7) stearyl benzyl dimethylammonium chloride;
8) tallow trimethylammonium chloride;
9) hydrogenated tallow trimethylammonium chloride;
10) C_{12-14} alkyl hydroxyethyl dimethylammonium chloride;
11) C_{12-18} alkyl dihydroxyethyl methylammonium chloride;
12) di(stearoyloxyethyl) dimethylammonium chloride (DSOEDMAC);
13) di(tallowoyloxyethyl) dimethylammonium chloride;
14) ditallow imidazolinium methylsulfate;
15) 1-(2-tallowylamidoethyl)-2-tallowyl imidazolinium methylsulfate.

Biodegradable quaternary ammonium compounds have been presented as alternatives to the traditionally used di-long alkyl chain ammonium chlorides and methyl sulfates. Such quaternary ammonium compounds contain long chain

alk(en)yl groups interrupted by functional groups such as carboxy groups. Said materials and fabric softening compositions containing them are disclosed in numerous publications such as EP-A-0,040,562, and EP-A-0,239,910.

Non-limiting examples of softener-compatible anions for the quaternary ammonium compounds and amine precursors include chloride or methyl sulfate.

Others

Other components used in detergentcompositions may be employed, such as soil-suspending agents, soil-release agents, optical brighteners, abrasives, bactericides, tarnish inhibitors, coloring agents, and/or encapsulated or non-encapsulated perfumes, examples of which are disclosed in U.S. Patent Nos. 5,707,950, 5,576,282 and 5,728,671.

Is is well known in the art that free chlorine in tap water rapidly deactivates the enzymes comprised in detergent compositions. Therefore, using chlorine scavenger such as perborate, ammonium sulfate, sodium sulphite or polyethyleneimine at a level above 0.1% by weight of total composition, in the formulas will provide improved through the wash stability of the detergent enzymes. Compositions comprising chlorine scavenger are described in the European patent application 92870018.6 filed January 31, 1992.

Alkoxylated polycarboxylates such as those prepared from polyacrylates are useful herein to provide additional grease removal performance. Such materials are described in WO 91/08281 and PCT 90/01815 at p. 4 et seq., incorporated herein by reference. Chemically, these materials comprise polyacrylates having one ethoxy side-chain per every 7-8 acrylate units. The side-chains are of the formula $-(CH_2CH_2O)_m(CH_2)_nCH_3$ wherein m is 2-3 and n is 6-12. The side-chains are ester-linked to the polyacrylate "backbone" to provide a "comb" polymer type structure. The molecular weight can vary, but is typically in the range of about 2000 to about 50,000. Such alkoxylated polycarboxylates can comprise from about 0.05% to about 10%, by weight, of the compositions herein.

Method of washing

The compositions of the invention may be used in essentially any washing or cleaning methods, including soaking methods, pretreatment methods and methods

with rinsing steps for which a separate rinse aid composition may be added.

The process described herein comprises contacting fabrics with a laundering solution in the usual manner and exemplified hereunder.

The process of the invention is conveniently carried out in the course of the cleaning process. The method of cleaning is preferably carried out at 5°C to 95°C, especially between 10°C and 60°C. The pH of the treatment solution is preferably from 7 to 11.

The following examples are meant to exemplify compositions of the present invention, but are not necessarily meant to limit or otherwise define the scope of the invention. In the detergent compositions, the enzyme levels are expressed by pure enzyme by weight of the total composition and unless otherwise specified, the detergent ingredients are expressed by weight of the total compositions. The abbreviated component identifications herein have the following meanings:

LAS : Sodium linear C_{12} alkyl benzene sulphonate

TAS : Sodium tallow alkyl sulphate

CXYAS : Sodium C_{1X} - C_{1Y} alkyl sulfate

25EY : A C_{12}-C_{15} predominantly linear primary alcohol condensed with an average of Y moles of ethylene oxide

CXYEZ : A C_{1X} - C_{1Y} predominantly linear primary alcohol condensed with an average of Z moles of ethylene oxide

XYEZS : C_{1X} - C_{1Y} sodium alkyl sulfate condensed with an average of Z moles of ethylene oxide per mole

QAS : $R_2.N^+(CH_3)_2(C_2H_4OH)$ with $R_2 = C_{12}$-C_{14}

Soap	:	Sodium linear alkyl carboxylate derived from a 80/20 mixture of tallow and coconut oils.
Nonionic	:	C_{13}-C_{15} mixed ethoxylated/propoxylated fatty alcohol with an average degree of ethoxylation of 3.8 and an average degree of propoxylation of 4.5 sold under the tradename Plurafac LF404 by BASF Gmbh.
CFAA	:	C_{12}-C_{14} alkyl N-methyl glucamide
TFAA	:	C_{16}-C_{18} alkyl N-methyl glucamide.
TPKFA	:	C12-C14 topped whole cut fatty acids.
DEQA	:	Di-(tallow-oxy-ethyl) dimethyl ammonium chloride.
Neodol 45-13	:	C14-C15 linear primary alcohol ethoxylate, sold by Shell Chemical CO.
Silicate	:	Amorphous Sodium Silicate (SiO_2:Na_2O ratio = 2.0)
NaSKS-6	:	Crystalline layered silicate of formula δ-$Na_2Si_2O_5$.
Carbonate	:	Anhydrous sodium carbonate with a particle size between 200 μm and 900μm.
Bicarbonate	:	Anhydrous sodium bicarbonate with a particle size between 400 μm and 1200μm.
STPP	:	Anhydrous sodium tripolyphosphate

MA/AA	:	Copolymer of 1:4 maleic/acrylic acid, average molecular weight about 70,000-80,000
Zeolite A	:	Hydrated Sodium Aluminosilicate of formula $Na_{12}(AlO_2SiO_2)_{12}$. $27H_2O$ having a primary particle size in the range from 0.1 to 10 micrometers
Citrate	:	Tri-sodium citrate dihydrate of activity 86,4% with a particle size distribution between 425 μm and 850 μm.
Citric	:	Anhydrous citric acid
PB1	:	Anhydrous sodium perborate monohydrate bleach, empirical formula $NaBO_2.H_2O_2$
PB4	:	Anhydrous sodium perborate tetrahydrate
Percarbonate	:	Anhydrous sodium percarbonate bleach of empirical formula $2Na_2CO_3.3H_2O_2$
TAED	:	Tetraacetyl ethylene diamine.
NOBS	:	Nonanoyloxybenzene sulfonate in the form of the sodium salt.
Photoactivated Bleach	:	Sulfonated zinc phtalocyanine encapsulated in dextrin soluble polymer.

Protease	:	Proteolytic enzyme sold under the tradename Savinase, Alcalase, Durazym by Novo Nordisk A/S, Maxacal, Maxapem sold by Gist-Brocades and proteases described in patents WO91/06637 and/or WO95/10591 and/or EP 251 446.
Amylase	:	Amylolytic enzyme sold under the tradename Purafact Ox Am^R described in WO 94/18314, WO96/05295 sold by Genencor; Termamyl®, Fungamyl® and Duramyl®, all available from Novo Nordisk A/S and those described in WO95/26397.
Lipase	:	Lipolytic enzyme sold under the tradename Lipolase, Lipolase Ultra by Novo Nordisk A/S
Hexosaminidase		A hexosaminidase according to the present invention compositions, having MIC less than about 0.125%.
Cellulase	:	Cellulytic enzyme sold under the tradename Carezyme, Celluzyme and/or Endolase by Novo Nordisk A/S.
CMC	:	Sodium carboxymethyl cellulose.
HEDP	:	1,1-hydroxyethane diphosphonic acid.
DETPMP	:	Diethylene triamine penta (methylene phosphonic acid), marketed by Monsanto under the Trade name Dequest 2060.
PVNO	:	Poly(4-vinylpyridine)-N-Oxide.
PVPVI	:	Poly (4-vinylpyridine)-N-oxide/copolymer of vinyl-imidazole and vinyl-pyrrolidone.

Brightener 1	:	Disodium 4,4'-bis(2-sulphostyryl)biphenyl.
Brightener 2	:	Disodium 4,4'-bis(4-anilino-6-morpholino-1.3.5-triazin-2-yl) stilbene-2:2'-disulfonate.
Silicone antifoam	:	Polydimethylsiloxane foam controller with siloxane-oxyalkylene copolymer as dispersing agent with a ratio of said foam controller to said dispersing agent of 10:1 to 100:1.
Granular Suds Suppressor	:	12% Silicone/silica, 18% stearyl alcohol,70% starch in granular form
SRP 1	:	Sulfobenzoyl or sodium isethionate end capped esters with oxyethylene oxy and terephtaloyl backbone.
SRP 2	:	Diethoxylated poly (1,2 propylene terephtalate) short block polymer.
Sulphate	:	Anhydrous sodium sulphate.
HMWPEO	:	High molecular weight polyethylene oxide

Example 1

The following detergent formulations, according to the present invention are prepared, where I and III are phosphorus-containing detergent compositions, and II is a zeolite-containing detergent composition:

	I	II	III
Blown Powder:			
STPP	24.0	-	24.0

Zeolite A	-	24.0	-
C45AS	9.0	6.0	13.0
MA/AA	2.0	4.0	2.0
LAS	6.0	8.0	11.0
TAS	2.0	-	-
Silicate	7.0	3.0	3.0
CMC	1.0	1.0	0.5
Brightener 2	0.2	0.2	0.2
Soap	1.0	1.0	1.0
DETPMP	0.4	0.4	0.2
Spray On			
C45E7	2.5	2.5	2.0
C25E3	2.5	2.5	2.0
Silicone antifoam	0.3	0.3	0.3
Perfume	0.3	0.3	0.3
Dry additives:			
Carbonate	6.0	13.0	15.0
PB4	18.0	18.0	10.0
PB1	4.0	4.0	0
TAED	3.0	3.0	1.0
Photoactivated bleach	0.02	0.02	0.02
Protease	0.01	0.01	0.01
Lipase	0.009	0.009	–
Amylase	0.002	–	0.001
Hexosaminidase	0.05	0.01	0.001
Dry mixed sodium sulfate	3.0	3.0	5.0
Balance (Moisture & Miscellaneous)	100.0	100.0	100.0
Density (g/litre)	630	670	670

Example 2

The following nil bleach-containing detergent formulations of particular use in the

washing of colored clothing, according to the present invention are prepared:

	I	II	III
Blown Powder			
Zeolite A	15.0	15.0	-
Sodium sulfate	0.0	5.0	-
LAS	3.0	3.0	-
DETPMP	0.4	0.5	-
CMC	0.4	0.4	-
MA/AA	4.0	4.0	-
Agglomerates			
C45AS	-	-	11.0
LAS	6.0	5.0	-
TAS	3.0	2.0	-
Silicate	4.0	4.0	-
Zeolite A	10.0	15.0	13.0
CMC	-	-	0.5
MA/AA	-	-	2.0
Carbonate	9.0	7.0	7.0
Spray On			
Perfume	0.3	0.3	0.5
C45E7	4.0	4.0	4.0
C25E3	2.0	2.0	2.0
Dry additives			
MA/AA	-	-	3.0
NaSKS-6	-	-	12.0
Citrate	10.0	-	8.0
Bicarbonate	7.0	3.0	5.0
Carbonate	8.0	5.0	7.0
PVPVI/PVNO	0.5	0.5	0.5
Protease	0.026	0.016	0.047
Lipase	0.009	–	0.009

Amylase	0.005	0.005	--
Hexosaminidase	0.05	0.01	0.001
Cellulase	0.006	0.006	--
Silicone antifoam	5.0	5.0	5.0
Dry additives			
Sodium sulfate	0.0	9.0	0.0
Balance (Moisture and Miscellaneous)	100.0	100.0	100.0
Density (g/litre)	700	700	700

Example 3

The following detergent formulations, according to the present invention are prepared:

	I	II	III	IV
LAS	20.0	14.0	24.0	22.0
QAS	0.7	1.0	-	0.7
TFAA	-	1.0	-	-
C25E5/C45E7	-	2.0	-	0.5
C45E3S	-	2.5	-	-
STPP	30.0	18.0	30.0	22.0
Silicate	9.0	5.0	10.0	8.0
Carbonate	13.0	7.5	-	5.0
Bicarbonate	-	7.5	-	-
DETPMP	0.7	1.0	-	-
SRP 1	0.3	0.2	-	0.1
MA/AA	2.0	1.5	2.0	1.0
CMC	0.8	0.4	0.4	0.2
Hexosaminidase	0.05	0.01	0.001	0.05
Protease	0.008	0.01	0.026	0.026

Amylase	0.007	--	0.005	0.002
Lipase	0.004	--	--	0.002
Cellulase	0.0015	0.0005	-	-
Photoactivated bleach	70ppm	45ppm	-	10ppm
Brightener 1	0.2	0.2	0.08	0.2
PB1	6.0	2.0	-	-
NOBS	2.0	1.0	-	-
Balance (Moisture and Miscellaneous)	100	100	100	100

Example 4

The following liquid detergent formulations, according to the present invention are prepared:

	I	II	III	IV	V	VI	VII	VIII
LAS	10.0	13.0	9.0	-	25.0	-	-	-
C25AS	4.0	1.0	2.0	10.0	-	13.0	18.0	15.0
C25E3S	1.0	-	-	3.0	-	2.0	2.0	4.0
C25E7	6.0	8.0	13.0	2.5	-	-	4.0	4.0
TFAA	-	-	-	4.5	-	6.0	8.0	8.0
QAS	-	-	-	-	3.0	1.0	-	-
TPKFA	2.0	-	13.0	2.0	-	15.0	7.0	7.0
Rapeseed fatty acids	-	-	-	5.0	-	-	4.0	4.0
Citric	2.0	3.0	1.0	1.5	1.0	1.0	1.0	1.0
Dodecenyl/ tetradecenyl succinic acid	12.0	10.0	-	-	15.0	-	-	-
Oleic acid	4.0	2.0	1.0	-	1.0	-	-	-
Ethanol	4.0	4.0	7.0	2.0	7.0	2.0	3.0	2.0
1,2 Propanediol	4.0	4.0	2.0	7.0	6.0	8.0	10.0	13.-

Mono Ethanol Amine	-	-	-	5.0	-	-	9.0	9.0
Tri Ethanol Amine	-	-	8	-	-	-	-	-
NaOH (pH)	8.0	8.0	7.6	7.7	8.0	7.5	8.0	8.2
Ethoxylated tetraethylene pentamine	0.5	-	0.5	0.2	-	-	0.4	0.3
DETPMP	1.0	1.0	0.5	1.0	2.0	1.2	1.0	-
SRP 2	0.3	-	0.3	0.1	-	-	0.2	0.1
PVNO	-	-	-	-	-	-	-	0.10
Hexosaminidase	0.05	0.01	0.001	0.05	0.01	0.001	0.05	0.05
Protease	.005	.005	.004	.003	0.08	.005	.003	.006
Lipase	-	.002	-	.0002	-	-	.003	.003
Amylase	.002	--	--	.004	.002	.008	.005	.005
Cellulase	-	-	-	.0001	-	-	.0004	.0004
Boric acid	0.1	0.2	-	2.0	1.0	1.5	2.5	2.5
Na formate	-	-	1.0	-	-	-	-	-
Ca chloride	-	0.015	-	0.01	-	-	-	-
Bentonite clay	-	-	-	-	4.0	4.0	-	-
Suspending clay SD3	-	-	-	-	0.6	0.3	-	-
Balance Moisture and Miscellaneous	100	100	100	100	100	100	100	100

Example 5

Granular fabric detergent compositions which provide "softening through the wash" capability are prepared in accord with the present invention :

	I	II
45AS	-	10.0
LAS	7.6	-
68AS	1.3	-
45E7	4.0	-
25E3	-	5.0
Coco-alkyl-dimethyl hydroxy-ethyl ammonium chloride	1.4	1.0
Citrate	5.0	3.0
Na-SKS-6	-	11.0
Zeolite A	15.0	15.0
MA/AA	4.0	4.0
DETPMP	0.4	0.4
PB1	15.0	-
Percarbonate	-	15.0
TAED	5.0	5.0
Smectite clay	10.0	5.0
HMWPEO	-	0.1
Hexosaminidase	0.05	0.01
Protease	0.02	0.01
Lipase	0.02	0.01
Amylase	0.01	0.005
Cellulase	0.001	-
Silicate	3.0	5.0
Carbonate	10.0	10.0
Granular suds suppressor	1.0	4.0
CMC	0.2	0.1
Water/minors	Up to 100%	

Example 6

Syndet bar fabric detergent compositions are prepared in accord with the present invention :

	I	II	III	IV
C26 AS	20.00	20.00	20.00	20.00
CFAA	5.0	5.0	5.0	5.0
LAS (C11-13)	10.0	10.0	10.0	10.0
Sodium carbonate	25.0	25.0	25.0	25.0
Sodium pyrophosphate	7.0	7.0	7.0	7.0
STPP	7.0	7.0	7.0	7.0
Zeolite A	5.0	5.0	5.0	5.0
CMC	0.2	0.2	0.2	0.2
Polyacrylate (MW 1400)	0.2	0.2	0.2	0.2
Coconut monethanolamide	5.0	5.0	5.0	5.0
Hexosaminidase	0.05	0.01	0.001	0.05
Amylase	0.01	--	0.005	--
Protease	0.3	-	0.5	0.05
Brightener, perfume	0.2	0.2	0.2	0.2
CaSO4	1.0	1.0	1.0	1.0
MgSO4	1.0	1.0	1.0	1.0
Water	4.0	4.0	4.0	4.0

Filler* : balance to 100%

*Can be selected from convenient materials such as CaCO3, talc, clay (Kaolinite, Smectite), silicates, and the like.

Example 7

	Weight %	
Ingredients	**A**	**B**
STPP	24.0	45

Sodium carbonate	20.0	13.5
Silicate	15.0	13.5
Nonionic surfactants	2.0	2.0
MA/AA	4.0	–
Protease	0.083	0.083
Amylase	0.005	0.005
Hexosaminidase	0.01	0.05
PB1	14.5	14.5
Cobalt catalyst*	0.008	–
Dibenzoyl peroxide (18% active)	4.4	4.4
Water, sodium sulfate and misc.	Balance	Balance

*Pentaamineacetatocobalt (III) nitrate.

Example 8

Light-duty liquid dishwashing detergent formulae are prepared as follows:

	Composition		
Ingredient	**A**	**B**	**C**
		% Weight	
Surfactant	32.00	29.50	30.75
Ethanol	4.00	4.00	4.00
Ammonium citrate	0.06	0.06	0.06
Magnesium chloride	3.32	3.32	3.32
Ammonium sulfate	0.08	0.08	0.08
Hydrogen peroxide	200 ppm	–	–
Perfume	0.18	0.18	0.18
Protease	0.005	0.005	0.005
Amylase	0.005	0.005	0.005
Hexosaminidase	0.05	0.05	0.05
Water and minors	Balance	Balance	Balance

SEQUENCE LISTING

(1) GENERAL INFORMATION:

(i) APPLICANT: ANDRE CHRISTIAN CONVENTS
ROSA LAURA MOESE
ANN MARGARET WOLFF

(ii) TITLE OF INVENTION: LAUNDRY AND CLEANING COMPOSITIONS CONTAINING HEXOSAMINIDASE ENZYMES

(iii) NUMBER OF SEQUENCES: 11

(iv) CORRESPONDENCE ADDRESS:
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(C) CITY: CINCINNATI
(D) STATE: OHIO
(E) COUNTRY: USA
(F) ZIP: 45253-8707

(v) COMPUTER READABLE FORM:
(A) MEDIUM TYPE: Diskette
(B) COMPUTER: IBM PC compatible
(C) OPERATING SYSTEM: PC-DOS/MS-DOS
(D) SOFTWARE: PatentIn Release #1.0, Version #1.25

(vi) CURRENT APPLICATION DATA:
(A) APPLICATION NUMBER:
(B) FILING DATE: August 19, 1997
(C) CLASSIFICATION:

(viii) ATTORNEY/AGENT INFORMATION:
(A) NAME: ZERBY, KIM WILLIAM
(B) REGISTRATION NUMBER: 32,323
(C) REFERENCE/DOCKET NUMBER: Case 6616P2

(ix) TELECOMMUNICATION INFORMATION:
(A) TELEPHONE: 513-627-2885
(B) TELEFAX: 513-627-0318

(2) INFORMATION FOR SEQ ID NO:1:

(i) SEQUENCE CHARACTERISTICS:
(A) LENGTH: 611 amino acids
(B) TYPE: amíno acid
(C) STRANDEDNESS: single
(D) TOPOLOGY: linear

(ii) MOLECULE TYPE: protein

(xi) SEQUENCE DESCRIPTION: SEQ ID NO: 1:

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  1 MNYRIDFAVL SEHPQFCRFG LTLHNLSDQD LKAWSLHFTI DRYIQPDSIS
 51 HSQIHQVGSF CSLTPEQDVI NSNSHFYCEF SIKTAPFPFH YYTDGIKAAF
101 VQINDVEPRV RHDVIVTPIA LASPYRERSE IPATDAATLS LLPKPNHIER
151 LDGEFALTAG SQISLQSSCA ETAATWLKQE LTHLYQWQPH DIGSADIVLR
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201 TNPTLDEGAY LLSVDRKPIR LEASSHIGFV HASATLLQLV RPDGDNLLVP
251 HIVIKDAPRF KYRGMMLDCA RHFHPLERVK RLINQLAHYK FNTFHWHLTD
301 DEGWRIEIKS LPQLTDIGAW RGVDEVLEPQ YSLLTEKHGG FYTQEEIREV
351 IAYAAERGIT VIPEIDIPGH SRAAIKALPE WLFDEDDQSQ YRSIQYYNDN
401 VLSPALPGTY RFLDCVLEEV AALFPSHFIH IGADEVPDGV WVNSPKCQAL
451 MAEEGYTDAK ELQGHLLRYA EKKLKSLGKR MVGWEEAQHG DKVSKDTVIY
501 SWLSEQAALN CARQGFDVIL QPGQFTYLDI AQDYAPEEPG VDWAGVTPLE
551 RAYRYEPLVE VPEHDPLRKR ILGIQCALWC ELVNNQDRMD YMIYPRLTAL
601 AGSGLDTKIP A

2) INFORMATION FOR SEQ ID NO: 2:

(i) SEQUENCE CHARACTERISTICS:

(A) LENGTH: 430 amino acids

(B) TYPE: amino acid

(C) STRANDEDNESS: single

(D) TOPOLOGY: linear

(ii) MOLECULE TYPE: protein

(xi) SEQUENCE DESCRIPTION: SEQ ID NO: 2:

1 PRFPYRGIFL DVARNFHKKD AVLRLLDQMA AYKLNKFHFH LSDDEGWRIE
51 IPGLPELTEV GGQRCHDLSE TTCLLPQYGQ GPDVYGGFFS RQDYIDIIKY
101 AQARQIEVIP EIDMPAHARA AVVSMEARYK KLHAAGKEQE ANEFRLVDPT
151 DTSNTTSVQF FNRQSYLNPC LDSSQRFVDK VIGEIAQMHK EAGQPIKTWH
201 FGGDEAKNIR LGAGYTDKAK PEPGKGIIDQ SNEDKPWAKS QVCQTMIKEG
251 KVADMEHLPS YFGQEVSKLV KAHGIDRMQA WQDGLKDAES SKAFATSRVG
301 VNFWDTLYWG GFDSVNDWAN KGYEVVVSNP DYVYMDFPYE VNPDERGYYW
351 GTRFSDERKV FSFAPDNMPQ NAETSVDRDG NHFNAKSDKP WPGAYGLSAQ
401 LWSETQRTDP QMEYMIFPRA LSVAERSWHR

2) INFORMATION FOR SEQ ID NO: 3:

(i) SEQUENCE CHARACTERISTICS:

(A) LENGTH: 777 amino acids

(B) TYPE: amino acid

(C) STRANDEDNESS: single

(D) TOPOLOGY: linear

(ii) MOLECULE TYPE: protein

(xi) SEQUENCE DESCRIPTION: SEQ ID NO: 3:

1 MKRLTFGACI CCLLSLMACS QKAKQVQIPE YDKGINIIPL PMQLTESDDS
51 FEVDDKTTIC VSAEELKPIA KLLADKLRAS ADLSLQIEIG EEPSGNAIYI
101 GVDTALPLKR EGYMLRSDKR GVSIIGKSAH GAFYGMQTLL QLLPAEVESS
151 NEVLLPMTVP GVEIKDEPAF GYRGFMLDVC RHFLSVEDIK KHIDIMAMFK
201 INRFHWHLTE DQAWRIEIKK YPRLTEVGST RTEGDGTQYS GFYTQEQVRD

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251 IVQYASDHFI TVIPMIEMPG HAMAALAAYP QFRCFPREFK PRIIWGVEQD
301 VYCAGKDSVF RFISDVIDEV APLFPGTYFH IGGDECPKDR WKACSLCQKR
351 MRDNGLKDEH ELQSYFIKQA EKVLQKHGKR LIGWDEILEG GLAPSATVMS
401 WRGEDGGIAA ANMNHDVIMT PGSGGLYLDH YQGDPTVEPV AIGGYAPLEQ
451 VYAYNPLPKE LPADKHRYVL GAQANLWAEY LYTSERYDYQ AYPRLLAVAE
501 LTWTPLAKKD FADFCRRLDN ACVRLDMHGI NYHIPLPEQP GGSSDFIAFT
551 DKAKLTFTTS RPMKMVYTLD ETEPSLTSTP YTVPLEFAQT GLLKIRTVTA
601 GGKMSPVRRI RVEKQPFNMS MEVPAPKPGL TIRTAYGDLY DVPDLQQVAS
651 WEVGTVSSLE EIMHGKEKIT SPEVLERRVV EATGYVLIPE DGVYEFSTEN
701 NEFWIDNVKL IDNVGEVKKF SRRNSSRALQ KGYHPIKTIW VGAIQGAWPT
751 YWNYSRVMIR LKGEEKFKPI SSDMLFQ
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2) INFORMATION FOR SEQ ID NO: 4:

(i) SEQUENCE CHARACTERISTICS:

(A) LENGTH: 562 amino acids

(B) TYPE: amino acid

(C) STRANDEDNESS: single

(D) TOPOLOGY: linear

(ii) MOLECULE TYPE: protein

(xi) SEQUENCE DESCRIPTION: SEQ ID NO: 4:

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  1 MVLDKMIIFH LLLWLCNVVV HAAKVEILPA PQSVTWENDT AIIINPRLLQ
 51 ANTSCPLLED AFVRTVSAIE KLKWHPFPID DFNTANGKNI KTSLVHIQVD
101 DATVDLQLGV NESYTLKINT DGINIHAATT WGALHGLVSL QQLIIHTSED
151 KYVVPLSVTI SDFPNFKHRG LMIDSGRNFL TVDSILEQID IMALSKMNSL
201 HWHLADSQSW PVALESYPHM IKDAYSNDEV YSKNDLKYIV DYARARGVRV
251 IPEIDMPGHA RAGWKQVDPT IVECADAFWT DAAVEPPPGQ LNIESEKTYE
301 VISNVYNELS DIFIDDVFHV GNDELQEKCY SAQLLPNNTV TDLLKRYLKK
351 ALPIFNKVNH RKLTMWDDVL LSDVSADKIP SNITLQVWHE ISGVKNLTSR
401 GYDVVVSLSD FLYLDCGNAG WVTNDPRYVE TPENVDFNTG QGGSWCGPYK
451 SYQRIYNFDF TANLTETEKN HVLGREAALW SEQVDSTVLT TKIWPRTAAL
501 AELTWSGNKD SNGHHRGYEF TQRILNFREY LVKLGYGVSP LVPKYCLLNP
551 HACDLYKNPP VY
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2) INFORMATION FOR SEQ ID NO: 5:

(i) SEQUENCE CHARACTERISTICS:

(A) LENGTH: 847 amino acids

(B) TYPE: amino acid

(C) STRANDEDNESS: single

(D) TOPOLOGY: linear

(ii) MOLECULE TYPE: protein

(xi) SEQUENCE DESCRIPTION: SEQ ID NO: 5:

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  1 MASDIDQKDV DYAAKNLKLT TSLVANKPKD CPPEAPWGAC YRVEINLENT
 51 GSKSLNENVE IYFSSIHRTL GSKSEEFKVE HINGDLHKIT TTEKPKGLKG
101 GKTKSFQVDF MNWIVSNSDF MPNYYVASEH LEGRNILNTV PIDAVHITEE
151 VSGFTTGIKH TPNQLKRTAN DLLPAATATT RYEQYSKVKD LGADAVSAHI
201 LPTPLETSVH EGSLNIAQGI NIVSDALPAD QVEALNFRFE TLGVNTGTGV
251 PVNVTIKADS SKKSGSYTLD VTSSGIRIVG VDKAGAFYGV QSLAGLVTVG
301 KDTINQVSIN DEPRLDYRGM HMDVSRNFHS KELVFRFLDQ MAAYKMNKFH
351 FHLADDEGWR LEINGLPELT QVGAHRCHDV EQNKCMMPQL GSGAELPNNG
401 SGYYTREDYK EILAYASARN IQVIPSMDMP GHSLAAVKSM EARYRKFMAE
451 GDVVKAEMYL LSDPNDTTQY YSIQHYQDNT INPCMESSFV FMDKVIDEIN
501 KLHKEGGQPL TDYHIGADET AGAWGDSPEC RKMFVAPESG VKNAKDINGY
551 FINRISHILD AKGLTLGAWN DGLSHKALDA SSLAGNPPKA WVWGTMFWGG
601 VDQYNSFANK GYDVVVTPPD AYYFDMPYEN DPEERGYYWA TRFNDTKKVF
651 SFMPENVPAN VEWMTDRMGA KISATTGEKT HDFLGVQGAL WSETIRTDAQ
701 VEYMVLPRMI AVAERGWHKA SWEEEHKEGI TYTSNVDGHE GTTHLNDNIA
751 TRDADWAHPS NILGYKEMPK LDKAGITYRL PVLGAVIKNN ILDVVTEFHG
801 VAIQYSLDGK TWHKYDDTKK PQVSTKALVR SVSTNGRTGR AVEVLAK
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2) INFORMATION FOR SEQ ID NO: 6:

(i) SEQUENCE CHARACTERISTICS:

(A) LENGTH: 1589 base pairs

(B) TYPE: nucleic acid

(C) STRANDEDNESS: single

(D) TOPOLOGY: linear

(ii) MOLECULE TYPE: cDNA

(iii) HYPOTHETICAL: NO

(iii) ANTI-SENSE: NO

(v) FRAGMENT TYPE: internal

(xi) SEQUENCE DESCRIPTION: SEQ ID NO: 6:

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   1 atgacaagct ccaggctttg gttttcgctg ctgctggcgg cagcgttcgc
  51 aggacgggcg acggccctct ggccctggcc tcagaacttc caaacctccg
 101 accagcgcta cgtcctttac ccgaacaact ttcaattcca gtacgatgtc
 151 agctcggccg cgcagcccgg ctgctcagtc ctcgacgagg ccttccagcg
 201 ctatcgtgac ctgcttttcg gttccgggtc ttggccccgt ccttacctca
 251 cagggaaacg gcatacactg gagaagaatg tgttggttgt ctctgtagtc
 301 acacctggat gtaaccagct tcctactttg gagtcagtgg agaattatac
 351 cctgaccata aatgatgacc agtgtttact cctctctgag actgtctggg
 401 gagctctccg aggtctggag acttttagcc agcttgtttg gaaatctgct
 451 gagggcacat tctttatcaa caagactgag attgaggact ttccccgctt
 501 tcctcaccgg ggcttgctgt tggatacatc tcgccattac ctgccactct
 551 ctagcatcct ggacactctg gatgtcatgg cgtacaataa attgaacgtg
 601 ttccactggc atctggtaga tgatccttcc ttcccatatg agagcttcac
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651 ttttccagag ctcatgagaa aggggtccta caaccctgtc acccacatct
701 acacagcaca ggatgtgaag gaggtcattg aatacgcacg gctccggggt
751 atccgtgtgc ttgcagagtt tgacactcct ggccacactt tgtcctgggg
801 accaggtatc cctggattac tgactccttg ctactctggg tctgagccct
851 ctggcacctt tggaccagtg aatcccagtc tcaataatac ctatgagttc
901 atgagcacat tcttcttaga agtcagctct gtcttcccag attttatctt
951 catcttggag gagatgaggt tgatttcacc tgctggaagt ccaacccaga
1001 gatccaggac tttatgagga agaaaggctt cggtgaggac ttcaagcagc
1051 tggagtcctt ctacatccag acgctgctgg acatcgtctc ttcttatggc
1101 aagggctatg tggtgtggca ggaggtgttt gataataaag taaagattca
1151 gccagacaca atcatacagg tgtggcgaga ggatattcca gtgaactata
1201 tgaaggagct ggaactggtc accaaggccg gcttccgggc ccttctctct
1251 gccccctggt acctgaaccg tatatcctat ggccctgact ggaaggattt
1301 ctacgtagtg gaacccctgg catttgaagg taccccctgag cagaaggctc
1351 tggtgattgg tggagaggct tgtatgtggg gagaatatgt ggacaacaca
1401 aacctggtcc ccaggctctg gcccagagca ggggctgttg ccgaaaggct
1451 gtggagcaac aagttgacat ctgacctgac atttgcctat gaacgtttgt
1501 cacacttccg ctgtgagttg ctgaggcgag gtgtccaggc ccaacccctc
1551 aatgtaggct tctgtgagca ggagtttgaa cagacctga

2) INFORMATION FOR SEQ ID NO: 7:

(i) SEQUENCE CHARACTERISTICS:

(A) LENGTH: 3670 base pairs

(B) TYPE: nucleic acid

(C) STRANDEDNESS: single

(D) TOPOLOGY: linear

(ii) MOLECULE TYPE: cDNA

(iii) HYPOTHETICAL: NO

(iii) ANTI-SENSE: NO

(v) FRAGMENT TYPE: internal

(xi) SEQUENCE DESCRIPTION: SEQ ID NO: 7:

1 ggtggtggca cctcctgccg cgcggtattc ggcatgcgtc cggcgtttga
51 ttggcgacag gaccggcagc gccaacctgt tgcttggcgt ggaacgcgat
101 ggacgccgtc attcacgcca tcaccttagc tgccgaacaa ggcggcctga
151 ataacgataa ctttggtcaa ctgcacgtgg gcttggcgct ggctggcgtg
201 agcaccaagc gacttggcat gctttatgca attgccacac cgtttgcgtc
251 gctcacgctc aataccgatg cctatggtgc gtgcctcggt gcgcaccacg
301 gtgacaacgg cgccatcatg attgctggca cgggctcatg cggtttgttc
351 ttgcaagacg gccaccagca cgtggtgggg ggacgtgagt tcccgatctc
401 cgatgagggc agtggcgcgg tgatgggact gcgcctgatt caacaagtgc
451 tgctgattga agatggtatt tatccggcca cgccacttag tcagtgtgtc
501 atgcagcatt gacacgatgt gacgccattg tcgcttggtc gaaatccgct

551 ttacctcgcg actatggtca attttcgccg cagattttcg cgttggcgaa
601 tcaaggtgac acgctagcaa tatccctgct gaaacagaca gcagcggata
651 tcgaaatgtt tttgaacgcc ctgcatcgca aaggggcaca gcgaatctgc
701 ttcatgggca gcatcgcgga acgcattcac gcatggttat cccctcccgt
751 tcagcaatgg atcgtcgcac cgcaagcgga tgcgatggag ggcgcattaa
801 tgtttgccgg caaagccgag cataatttgt attaagggtt gctcatgaac
851 tatcgaatag acttcgcggt attgtcagaa catccacagt tctgccgttt
901 tggcttgacg ctgcataacc tcagcgatca ggacttaaag gcctggagcc
951 tgcatttcac catcgatcgc tacattcagc ccgatagcat cagtcacagc
1001 cagattcatc aagtcggcag tttctgttcg ctcacgccgg agcaggacgt
1051 gataaattcc aacagccatt tctactgcga attcagcatc aaaaccgcgc
1101 cgtttccgtt tcactattac accgacggca tcaaagccgc gtttgtccaa
1151 attaatgatg tagagccgcg ggttcgtcac gacgtgatcg tcacccccat
1201 cgcactcgcc tccccctatc gggaacgcag cgagatcccg gccacggatg
1251 ccgcgacgtt gagcctgtta cccaaaccca atcatatcga acgcttggat
1301 ggtgaatttg cccttaccgc cggcagccag atttcattgc aatcctcttg
1351 tgcagaaact gccgccacgt ggctcaagca agaactgacg catctctatc
1401 agtggcagcc acacgatatt ggcagcgccg acattgtgct acgcaccaac
1451 ccaacgctgg atgaaggcgc ctatctgctg tcagtcgacc gcaaacctat
1501 tcgtttggaa gccagcagtc acatcggctt tgtccatgcc agtgcgacat
1551 tgctgcaatt ggttcgccca gatggcgaca acctgctggt gccacacatc
1601 gttatcaaag acgcaccgcg ctttaaatac cgcggcatga tgctggattg
1651 cgcgcgtcat tttcatccgc tggagcgcgt taaacgcctc atcaaccaac
1701 tggcgcatta caaattcaac acctttcatt ggcatctgac cgatgatgaa
1751 ggttggcgca ttgaaattaa gtctctacct caattgaccg acattggcgc
1801 gtggcgcggt gtggatgaag tcctggaacc gcaatacagc ctgctgaccg
1851 aaaaacacgg tggcttttac acccaagagg agatccgtga agtgatcgcc
1901 tacgccgcag aacgcggcat cacggtgatt ccagaaattg acattcccgg
1951 tcacagccga gcggcgatca aagccttacc ggaatggcta tttgacgaag
2001 atgaccaatc acaataccgc agcattcagt actacaacga caacgtgcta
2051 tcgccagccc tgcccggcac ctaccgtttt ctcgattgcg tattggagga
2101 agtggccgcg ctgtttccga gccatttcat tcacattggc gccgatgaag
2151 tgccagatgg cgtgtgggtc aacagcccga aatgtcaggc attgatggca
2201 gaagagggct acaccgacgc caaagagtta caagggcacc tgctgcgcta
2251 tgcggagaag aagctcaaat cactcggcaa acgcatggtc ggttgggaag
2301 aagcgcagca tggtgacaaa gtcagcaaag ataccgtgat ttattcttgg
2351 ttatccgaac aagccgcact gaactgcgcc cgtcaagggt ttgatgtcat
2401 tttacaaccg ggacagttta cgtacctcga cattgcgcaa gactacgcgc
2451 cagaagagcc gggcgtcgac tgggctggcg tgacgccact ggagcgcgcc
2501 tatcgctacg agccgctggt cgaggtgcca gaacacgacc cgctgcgcaa
2551 acgcattttg gggattcagt gcgcgctgtg gtgtgaactg gtcaacaatc
2601 aagaccgcat ggactacatg atctatccgc gtttgaccgc actggcggga

2651 agcggcttgg acacaaaaat cccagcgtga ttggctggat tacctggcgc
2701 gcctcaaagg ccatttaccc caacttgatc aacaaggcat ccgctaccgg
2751 gcgccttgga aagcataacg caacacgttt tctctagcat cgacattgag
2801 tggcgccaat gcgccactgt ttaaaaagga aattaccatg aaatacggct
2851 atttcgataa cgacaatcgc gaatacgtca ttactcgtcc cgatgttcct
2901 gcaccttgga ccaactacct cggcacggaa aaattctgca ccgtcatctc
2951 ccataatgcg gggggctact cgttctatca ctcacccgag tacaaccgtg
3001 tgaccaagtt ccgtccgaac ttcacacaag atcgtcccgg gcattacatc
3051 tatttgcgcg atgatgaaac cggtgatttc tggtcggtct cttggcagcc
3101 cgttgccaaa aaccttgacg atgcccatta cgaagtgcgc catggatgcc
3151 gtgtatgagt atctgttctc cccatacggt ttacacctca acgccccctc
3201 gtttgcaacg cccaacgatg acatcggttt tgtcacccgc gtctaccaag
3251 gcgtgaaaga aaacggtgcg attttctcgc atccgaaccc gtgggcatgg
3301 gtcgccgaag ccaaactggg acgcggtgat cgcgcgatgg aattctacga
3351 ttcgctcaac ccatacaacc agaacgacat cattgaaacg cgcgtggcag
3401 agccatattc ctacgtgcaa ttcatcatgg gtcgcgacca ccaagatcac
3451 ggccgtgcaa accacccttg gctcaccggt acatcgggct gggcctacta
3501 cgcgaccacc aacttcattt tgggagtgcg taccggattt gacaggttga
3551 ccgtggatcc atgtattcct gccgcttggt cgggctttga gcgtcacgcg
3601 cgagtggcgc ggtgcgacgt atcacatgtc agtccaaaac ccgaatggcg
3651 tcagcaaagg cgtgcaatcg

2) INFORMATION FOR SEQ ID NO: 8:

(i) SEQUENCE CHARACTERISTICS:

(A) LENGTH: 2000 base pairs

(B) TYPE: nucleic acid

(C) STRANDEDNESS: single

(D) TOPOLOGY: linear

(ii) MOLECULE TYPE: cDNA

(vi) ORIGINAL SOURCE:

(B) STRAIN: Trichoderma harzianum CBS 243.71

(ix) FEATURE:

(A) NAME/KEY: CDS

(B) LOCATION;86..1819

(xi) SEQUENCE DESCRIPTION: SEQ ID NO: 8:

GACATCTCCA CCATAGAGTC GACTCATTGC TGGCATACGG AGCATTCCAA TCTTACTCGT
60
AGTAGTGTTA TTGCCATCGC TCATC ATG CTG CCC AAG GCG ATC ATC GCG ATT
112
Met Leu Pro Lys Ala Ile Ile Ala Ile
1 5
GCC GCA TTG GCT TTC AGC CCA GCA AAT GCG CTG TGG CCC ATT CCT CAG
160

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Ala Ala Leu Ala Phe Ser Pro Ala Asn Ala Leu Trp Pro Ile Pro Gln
 10                  15                  20                  25

AAG ATC TCG ACC GGA GAC AGC GTG CTC TTT ATT GAC CAG GCT GTT AGG
208
Lys Ile Ser Thr Gly Asp Ser Val Leu Phe Ile Asp Gln Ala Val Arg
                 30                  35                  40

GTG ACT TAC AAT GGA GTA CCG ATC ATC CCT ATC GGC TAC AAC CCA CCG
256
Val Thr Tyr Asn Gly Val Pro Ile Ile Pro Ile Gly Tyr Asn Pro Pro
             45                  50                  55

GCC AGC TCC AAC TTC GAC AGC AGG CAA ATC GTC CAG GCG GCT GTC TCG
304
Ala Ser Ser Asn Phe Asp Ser Arg Gln Ile Val Gln Ala Ala Val Ser
         60                  65                  70

CGC GCT TTC CAA AAC ATC TTC AGC ACC AAC TAT GTG CCA TGG AAG CTT
352
Arg Ala Phe Gln Asn Ile Phe Ser Thr Asn Tyr Val Pro Trp Lys Leu
     75                  80                  85

CAC CCG CGT AAC AGC AAC TTT GAG CCG AAG GTG GCC CCT CAG AAC CGA
400
His Pro Arg Asn Ser Asn Phe Glu Pro Lys Val Ala Pro Gln Asn Arg
 90                  95                  100                 105

ATC CAG TCC ATC TCA ATT CAG CAG ACT GGA AAG GAT ACG TCC AAG ACG
448
Ile Gln Ser Ile Ser Ile Gln Gln Thr Gly Lys Asp Thr Ser Lys Thr
                110                 115                 120

TTC AAG CCG CGC GCC GGA GAC GTT GAT GAG TCG TAC TCT TTG ACC ATT
496
Phe Lys Pro Arg Ala Gly Asp Val Asp Glu Ser Tyr Ser Leu Thr Ile
            125                 130                 135

TCC AAG AAT GGA CAG GTC AAC ATC AGT GCC AAG TCT TCT ACT GGT GTG
544
Ser Lys Asn Gly Gln Val Asn Ile Ser Ala Lys Ser Ser Thr Gly Val
        140                 145                 150
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CTG CAC GCC CTC GAG ACC TTC TCG CAG CTT TTC TAC AAG CAC TCT GCT
592
Leu His Ala Leu Glu Thr Phe Ser Gln Leu Phe Tyr Lys His Ser Ala
    155                 160                 165

GGA CCT TTC TAC TAT ACG ACT CAG GCT CCC GTG TCC ATC ACA GAC GCT
640
Gly Pro Phe Tyr Tyr Thr Thr Gln Ala Pro Val Ser Ile Thr Asp Ala
170                 175                 180                 185

CCC AAA TAT CCC CAC CGT GGC ATC ATG CTT GAC CTT GCC CGT AAC TAT
688
Pro Lys Tyr Pro His Arg Gly Ile Met Leu Asp Leu Ala Arg Asn Tyr
                190                 195                 200

CAA ACC ATT GAT GAC ATC AAG AGG ACC ATT GAC GCC ATG TCG TGG AAC
736
Gln Thr Ile Asp Asp Ile Lys Arg Thr Ile Asp Ala Met Ser Trp Asn
            205                 210                 215

AAG CTT AAC CGC CTG CAC TTG CAC ATC ACC GAC TCT CAG TCG TGG CCG
784
Lys Leu Asn Arg Leu His Leu His Ile Thr Asp Ser Gln Ser Trp Pro
        220                 225                 230

CTG GTG ATC CCC TCG CTG CCT AAG CTG TCC CAG GCC GGT GCC TAC CAC
832
Leu Val Ile Pro Ser Leu Pro Lys Leu Ser Gln Ala Gly Ala Tyr His
    235                 240                 245

CCC AGC CTC GTC TAC ACT CCC GCA GAC CTT GCT GGC ATT TTC CAG TAC
880
Pro Ser Leu Val Tyr Thr Pro Ala Asp Leu Ala Gly Ile Phe Gln Tyr
250                 255                 260                 265

GGT GTC GCC CGC GGT GTT GAG GTC ATT ACG GAG ATC GAT ATG CCT GGC
928
Gly Val Ala Arg Gly Val Glu Val Ile Thr Glu Ile Asp Met Pro Gly
                270                 275                 280

CAC ATC GGT GTT ATC GAG CTC GCT TAC AGC GAT CTC ATT GTT GCC TAC
976
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His Ile Gly Val Ile Glu Leu Ala Tyr Ser Asp Leu Ile Val Ala Tyr
            285                 290                 295

GAA GAG ATG CCT TAC CAG TAC TAC TGC GCC GAG CCA CCT TGC GGT GCC
1024
Glu Glu Met Pro Tyr Gln Tyr Tyr Cys Ala Glu Pro Pro Cys Gly Ala
        300                 305                 310

TTT TCC ATC AAC AAC ACC AAG GTG TAC AGC TTC CTC GAT ACC CTG TTC
1072
Phe Ser Ile Asn Asn Thr Lys Val Tyr Ser Phe Leu Asp Thr Leu Phe
    315                 320                 325

GAC GAC CTT TTG CCT CGC GTC GCT CCT TAC AGC GCG TAC TTC CAC ACC
1120
Asp Asp Leu Leu Pro Arg Val Ala Pro Tyr Ser Ala Tyr Phe His Thr
330                 335                 340                 345

GGT GGT GAC GAG CTC AAC GCT AAC GAC TCC ATG CTC GAC TCT CAC ATC
1168
Gly Gly Asp Glu Leu Asn Ala Asn Asp Ser Met Leu Asp Ser His Ile
                350                 355                 360

AAG AGC AAC GAG ACC TCC GTT CTG CAA CCT CTG CTG CAA AAG TTC ATC
1216
Lys Ser Asn Glu Thr Ser Val Leu Gln Pro Leu Leu Gln Lys Phe Ile
            365                 370                 375

AAC TTT GCC CAC TCC AAG GTC CGT GCC GCG GGC TTG TCG CCA TTT GTC
1264
Asn Phe Ala His Ser Lys Val Arg Ala Ala Gly Leu Ser Pro Phe Val
        380                 385                 390

TGG GAG GAG ATG GTC ACC ACC TGG AAC CTG ACC CTC GGC AGC GAC ACC
1312
Trp Glu Glu Met Val Thr Thr Trp Asn Leu Thr Leu Gly Ser Asp Thr
        395             400                 405

GTC GTT CAG TCG TGG CTG GGT GGC GAT GCC GTC AAG AAC CTG GCT GAG
1360
Val Val Gln Ser Trp Leu Gly Gly Asp Ala Val Lys Asn Leu Ala Glu
410                 415                 420                 425
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AGC GGC CAC AAG GTC ATT GAC ACC GAC TAC AAC TTC TAC TAC TTG GAC
1408
Ser Gly His Lys Val Ile Asp Thr Asp Tyr Asn Phe Tyr Tyr Leu Asp
430 435 440

TGC GGC CGT GGT CAA TGG GTC AAC TTC CCT CCA GGA GAC TCC TAC AAC
1456
Cys Gly Arg Gly Gln Trp Val Asn Phe Pro Pro Gly Asp Ser Tyr Asn
445 450 455

ACC TAC TAC CCA TTC AAC GAC TGG TGC CAG CCC ACC AAG AAC TGG AGG
1504
Thr Tyr Tyr Pro Phe Asn Asp Trp Cys Gln Pro Thr Lys Asn Trp Arg
460 465 470

CTC ATC TAC TCT CAC GAC CCT GCA GCC AAC GTG TCT GCT TCG GCT GCC
1552
Leu Ile Tyr Ser His Asp Pro Ala Ala Asn Val Ser Ala Ser Ala Ala
475 480 485

AAG AAC GTC CTG GGA GGA GAG CTT GCC ATT TGG AGC GAG ATG ATT GAC
1600
Lys Asn Val Leu Gly Gly Glu Leu Ala Ile Trp Ser Glu Met Ile Asp
490 495 500 505

GCC AGC AAC CTG GAC AAC ATC ATC TGG CCT CGT GGC AGC GCC GCC GGT
1648
Ala Ser Asn Leu Asp Asn Ile Ile Trp Pro Arg Gly Ser Ala Ala Gly
510 515 520

GAG GTT TGG TGG TCC GGC AAT ACC GAT GCC TCT GGT GAG CAG CGC AGC
1696
Glu Val Trp Trp Ser Gly Asn Thr Asp Ala Ser Gly Glu Gln Arg Ser
525 530 535

CAG CTG GAC GTT GTT CCT CGT CTG AAC GAG TTC CGA GAA CGC TTG CTT
1744
Gln Leu Asp Val Val Pro Arg Leu Asn Glu Phe Arg Glu Arg Leu Leu
540 545 550

GCT CGT GGT GTC AGC GCG TTC CCC ATC CAG ATG ACC TAC TGC ACT CAG
1792

Ala Arg Gly Val Ser Ala Phe Pro Ile Gln Met Thr Tyr Cys Thr Gln
555 560 565

CTC AAC GCC ACT GCC TGC ACA CTA TTT TAAGTCTAAG ATGACTTTTT
1839
Leu Asn Ala Thr Ala Cys Thr Leu Phe
570 575

CTTTTATTGG GCAGGGTTTT TTCTATTTTT CACGTATTAT CATTAGTGTA CAGTGATTAA
1899

AACAGGTATG GCTTAAGAGG AGCTGGGAGG GTATCCGGCT TGGGGCGGTA TATTATTAAC
1959

TGTATATAAT TCAAATTCAT CTACATATAT GTTATGAAAA A
2000

2) INFORMATION FOR SEQ ID NO: 9:
(i) SEQUENCE CHARACTERISTICS:
(A) LENGTH: 2239 base pairs
(B) TYPE: nucleic acid
(C) STRANDEDNESS: single
(D) TOPOLOGY: linear
(ii) MOLECULE TYPE: cDNA
(vi) ORIGINAL SOURCE:
(B) STRAIN: Trichoderma harzianum CBS 243.71
(ix) FEATURE:
(A) NAME/KEY: CDS
(B) LOCATION; 282..2086
(xi) SEQUENCE DESCRIPTION: SEQ ID NO: 9:

CTGAGAAGCG GCACTTGCTG ATCTGCGTGG AACTTGGGGT TACAACGCAC CGGATAGCTC
60
ATCTCCCCAG GACCCCGGAA CTGGAGCTGG AACTGGAATT GGAGCTGGAG CGGACCCAGG
120
CCGGAGACGA GAAACACAGT GAATCACTCC TGCAAGGGGC GGGACAGGAA CGTGGACAGT
180
ATTTAGTTTA AGCAGCTGTC CCAGAGCTGT TCGCCCTGCT TCCAAGCTCG TGTGGCCTGA
240
CCCTGTATAA ACTCATTACG ACCATCAGCT CACAGCCGAC A ATG TTT TCC AGG
293
Met Phe Ser Arg
1

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GCC ATT GTC GCC GCA TTG GCC CTG AGC GGC CCG GCT TTT GCC CTG TGG
341
Ala Ile Val Ala Ala Leu Ala Leu Ser Gly Pro Ala Phe Ala Leu Trp
  5                  10                  15                  20

CCC GTG CCT AAA CAC TCC TCG ACC GGC AAT GAC ACG CTC TTT ATT GAC
389
Pro Val Pro Lys His Ser Ser Thr Gly Asn Asp Thr Leu Phe Ile Asp
                 25                  30                  35

CAG ACG GTC CAG GTT ACC TAC AAT GGT GAA CAG GTG TGG TGG ACT CCT
437
Gln Thr Val Gln Val Thr Tyr Asn Gly Glu Gln Val Trp Trp Thr Pro
             40                  45                  50

CCA TAT GAT GAC CCC GGA TCC CCG GAC TTT GCT GAG ACC AGG ATC GAT
485
Pro Tyr Asp Asp Pro Gly Ser Pro Asp Phe Ala Glu Thr Arg Ile Asp
         55                  60                  65

GAC CAA CAG GTT ACT TAC ACG GCC GGC TAC GTG CCT CCC AGC GGA CCG
533
Asp Gln Gln Val Thr Tyr Thr Ala Gly Tyr Val Pro Pro Ser Gly Pro
     70                  75                  80

CAT TTC ACC AGC AAG GAA ATC GTT CAA GGC GGC GTC TCG CGG ACA TTC
581
His Phe Thr Ser Lys Glu Ile Val Gln Gly Gly Val Ser Arg Thr Phe
 85                  90                  95                  100

GGC GCC ATC TTC CAG CAG GGC TTT GTG CCG TGG ATG CTG CGT GAA CGT
629
Gly Ala Ile Phe Gln Gln Gly Phe Val Pro Trp Met Leu Arg Glu Arg
                105                 110                 115

GAT TCG AAC TCT GAA CCG AAT CTA GGC GGA ACG CGG ATC CGG ACA CTG
677
Asp Ser Asn Ser Glu Pro Asn Leu Gly Gly Thr Arg Ile Arg Thr Leu
             120                 125                 130

CAG ATT ATA CAG ACT CAG CAC GAT TCT GCG AAT ACC TTC AAG CCT CTG
725
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Gln Ile Ile Gln Thr Gln His Asp Ser Ala Asn Thr Phe Lys Pro Leu
        135                 140                 145

AAT GGC GCA GTG AAT GAA TCC TAT GCC CTG GAT GTC GAC GCA AAG GGC
773
Asn Gly Ala Val Asn Glu Ser Tyr Ala Leu Asp Val Asp Ala Lys Gly
    150                 155                 160

CAC GCA TCT CTC ACC GCT CCG TCG TCA ACG GGC ATC CTT CGA GGC CTT
821
His Ala Ser Leu Thr Ala Pro Ser Ser Thr Gly Ile Leu Arg Gly Leu
165                 170                 175                 180

GAG ACC TTC TCC CAG CTC TTC TTC AAG CAT AGC TCC GGC ACT GCT TGG
869
Glu Thr Phe Ser Gln Leu Phe Phe Lys His Ser Ser Gly Thr Ala Trp
                185                 190                 195

TAT ACG CAG CTT GCA CCT GTT TCG ATC CGC GAT GAG CCC AAG TAT CCT
917
Tyr Thr Gln Leu Ala Pro Val Ser Ile Arg Asp Glu Pro Lys Tyr Pro
            200                 205                 210

CAC CGC GGC CTC CTG TTG GAT GTC AGC CGC CAT TGG TTC GAG GTT TCC
965
His Arg Gly Leu Leu Leu Asp Val Ser Arg His Trp Phe Glu Val Ser
        215                 220                 225

GAC ATT GAG CGC ACT ATC GAT GCT CTG GCC ATG AAC AAA ATG AAT GTG
1013
Asp Ile Glu Arg Thr Ile Asp Ala Leu Ala Met Asn Lys Met Asn Val
    230                 235                 240

CTG CAT CTG CAC GCT ACT GAC ACG CAG TCA TGG CCG CTG GAG ATT CCA
1061
Leu His Leu His Ala Thr Asp Thr Gln Ser Trp Pro Leu Glu Ile Pro
245                 250                 255                 260

TCC CTG CCT CTG CTG GCT GAG AAG GGC GCC TAT CAC AAG GGT TTG AGC
1109
Ser Leu Pro Leu Leu Ala Glu Lys Gly Ala Tyr His Lys Gly Leu Ser
                265                 270                 275
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TAC TCG CCA AGC GAT CTT GCG AGC ATC CAA GAA TAT GGT GTT CAT CGA
1157
Tyr Ser Pro Ser Asp Leu Ala Ser Ile Gln Glu Tyr Gly Val His Arg
280 285 290

GGT GTC CAG GTC ATT GTA GAG ATT GAT ATG CCG GGC CAC GTT GGA ATC
1205
Gly Val Gln Val Ile Val Glu Ile Asp Met Pro Gly His Val Gly Ile
295 300 305

GAC AAG GCA TAC CCC GGG CTT AGC AAC GCC TAC GGA GTC AAC CCG TGG
1253
Asp Lys Ala Tyr Pro Gly Leu Ser Asn Ala Tyr Gly Val Asn Pro Trp
310 315 320

CAG TGG TAC TGC GCC CAG CCG CCC TGC GGA TCT TTC AAG CTG AAC AAC
1301
Gln Trp Tyr Cys Ala Gln Pro Pro Cys Gly Ser Phe Lys Leu Asn Asn
325 330 335 340

ACG GAT GTC GAA AAG TTC ATT GAC AAG CTG TTT GAA GAT TTG CTG CCG
1349
Thr Asp Val Glu Lys Phe Ile Asp Lys Leu Phe Glu Asp Leu Leu Pro
345 350 355

CGT CTT TCG CCG TAC TCG GCC TAC TTT CAC ACT GGT GGC GAT GAG TAC
1397
Arg Leu Ser Pro Tyr Ser Ala Tyr Phe His Thr Gly Gly Asp Glu Tyr
360 365 370

AAG GCG AAC AAC TCG CTG CTC GAC CCG GCC CTT CGC ACA AAC GAC ATG
1445
Lys Ala Asn Asn Ser Leu Leu Asp Pro Ala Leu Arg Thr Asn Asp Met
375 380 385

AAC ACC CTG CAG CCG ATG CTG CAG CGC TTC TTG GAC CAC GTG CAT GGC
1493
Asn Thr Leu Gln Pro Met Leu Gln Arg Phe Leu Asp His Val His Gly
390 395 400

AAA GTT CGT GAT CTG GGA CTC GTT CCC ATG GTT TGG GAA GAA ATG ATT
1541

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Lys Val Arg Asp Leu Gly Leu Val Pro Met Val Trp Glu Glu Met Ile
405                 410                 415                 420

CTG GAT TGG AAC GCA ACT CTG GGC AAG GAT GTC GTT GCT CAA ACG TGG
1589
Leu Asp Trp Asn Ala Thr Leu Gly Lys Asp Val Val Ala Gln Thr Trp
                425                 430                 435

CTT GGC GGA GGA GCG ATT CAG AAG CTT GCT CAG GCT GGA TAC AAG GTT
1637
Leu Gly Gly Gly Ala Ile Gln Lys Leu Ala Gln Ala Gly Tyr Lys Val
            440                 445                 450

ATT GAC AGC AGC AAT GAC TTT TAC TAT CTC GAC TGT GGT CGT GGT GAG
1685
Ile Asp Ser Ser Asn Asp Phe Tyr Tyr Leu Asp Cys Gly Arg Gly Glu
        455                 460                 465

TGG CTC GAT TTT GCC AAT GGT GAC CCC TTT AAC AAC AAC TAT CCC TTT
1733
Trp Leu Asp Phe Ala Asn Gly Asp Pro Phe Asn Asn Asn Tyr Pro Phe
    470                 475                 480

CTC GAC TGG TGC GAC CCG ACC AAA AAC TGG AAG CTC ATG TAC TCA CAC
1781
Leu Asp Trp Cys Asp Pro Thr Lys Asn Trp Lys Leu Met Tyr Ser His
485                 490                 495                 500

GAG CCC ACG GAC GGC GTG TCC GAT GAT CTC AAG AAG AAT GTC ATT GGA
1829
Glu Pro Thr Asp Gly Val Ser Asp Asp Leu Lys Lys Asn Val Ile Gly
                505                 510                 515

GGC GAA GTT GCT GTC TGG ACT GAG ACC ATC GAT CCG ACC AGC TTG GAC
1877
Gly Glu Val Ala Val Trp Thr Glu Thr Ile Asp Pro Thr Ser Leu Asp
            520                 525                 530

TCC ATC ATC TGG CCG CGA GCG GGA GCG GCC GCT GAG ATT TGG TGG TCG
1925
Ser Ile Ile Trp Pro Arg Ala Gly Ala Ala Ala Glu Ile Trp Trp Ser
        535                 540                 545
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GGC AAG ATC GAT GAG AAG GGC CAG AAC CGA TCA CAG ATT GAT GCA CGG
1973
Gly Lys Ile Asp Glu Lys Gly Gln Asn Arg Ser Gln Ile Asp Ala Arg
550 555 560

CCA AGA TTA TCG GAG CAG CGA GAG CGC ATG TTG GCG AGG GGA GTT CGA
2021
Pro Arg Leu Ser Glu Gln Arg Glu Arg Met Leu Ala Arg Gly Val Arg
565 570 575 580

GGA ACG CCG ATT ACG CAG CTG TGG TGT AGT CAG GTT GAT GTT CAT AAC
2069
Gly Thr Pro Ile Thr Gln Leu Trp Cys Ser Gln Val Asp Val His Asn
585 590 595

TGC GAG TCT GGG AAT TA CTGATGCGGG TTGATGAACA AAGTATGTAA
2116
Cys Glu Ser Gly Asn
600

TGTGGTATAT ATGAATGTTT CTTTTTCACG CTGCTGTTAA AGGCCGGGGA CGTCTCGTT
2176

GTGATGACGG TTAGACTGAA AATCACTTAT AATGAATTCA AGTCATTCAA GATGAAAAAA
2236

AAA
2239

2) INFORMATION FOR SEQ ID NO: 10:
(i) SEQUENCE CHARACTERISTICS:
(A) LENGTH: 578 amino acids
(B) TYPE: amino acid
(D) TOPOLOGY: linear
(ii) MOLECULE TYPE: protein
(xi) SEQUENCE DESCRIPTION: SEQ ID NO: 10:

Met Leu Pro Lys Ala Ile Ile Ala Ile Ala Ala Leu Ala Phe Ser Pro
1 5 10 15
Ala Asn Ala Leu Trp Pro Ile Pro Gln Lys Ile Ser Thr Gly Asp Ser
20 25 30

Val Leu Phe Ile Asp Gln Ala Val Arg Val Thr Tyr Asn Gly Val Pro
35 40 45

Ile Ile Pro Ile Gly Tyr Asn Pro Pro Ala Ser Ser Asn Phe Asp Ser
50 55 60

Arg Gln Ile Val Gln Ala Ala Val Ser Arg Ala Phe Gln Asn Ile Phe
65 70 75 80

Ser Thr Asn Tyr Val Pro Trp Lys Leu His Pro Arg Asn Ser Asn Phe
85 90 95

Glu Pro Lys Val Ala Pro Gln Asn Arg Ile Gln Ser Ile Ser Ile Gln
100 105 110

Gln Thr Gly Lys Asp Thr Ser Lys Thr Phe Lys Pro Arg Ala Gly Asp
115 120 125

Val Asp Glu Ser Tyr Ser Leu Thr Ile Ser Lys Asn Gly Gln Val Asn
130 135 140

Ile Ser Ala Lys Ser Ser Thr Gly Val Leu His Ala Leu Glu Thr Phe
145 150 155 160

Ser Gln Leu Phe Tyr Lys His Ser Ala Gly Pro Phe Tyr Tyr Thr Thr
165 170 175

Gln Ala Pro Val Ser Ile Thr Asp Ala Pro Lys Tyr Pro His Arg Gly
180 185 190

Ile Met Leu Asp Leu Ala Arg Asn Tyr Gln Thr Ile Asp Asp Ile Lys
195 200 205

Arg Thr Ile Asp Ala Met Ser Trp As Lys Leu Asn Arg Leu His Leu
210 215 220

His Ile Thr Asp Ser Gln Ser Trp Pro Leu Val Ile Pro Ser Leu Pro
225 230 235 240

Lys Leu Ser Gln Ala Gly Ala Tyr His Pro Ser Leu Val Tyr Thr Pro
245 250 255

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Ala Asp Leu Ala Gly Ile Phe Gln Tyr Gly Val Ala Arg Gly Val Glu
            260                 265                 270

Val Ile Thr Glu Ile Asp Met Pro Gly His Ile Gly Val Ile Glu Leu
        275                 280                 285

Ala Tyr Ser Asp Leu Ile Val Ala Tyr Glu Glu Met Pro Tyr Gln Tyr
    290                 295                 300

Tyr Cys Ala Glu Pro Pro Cys Gly Ala Phe Ser Ile Asn Asn Thr Lys
305                 310                 315                 320

Val Tyr Ser Phe Leu Asp Thr Leu Phe Asp Asp Leu Leu Pro Arg Val
                325                 330                 335

Ala Pro Tyr Ser Ala Tyr Phe His Thr Gly Gly Asp Glu Leu Asn Ala
            340                 345                 350

Asn Asp Ser Met Leu Asp Ser His Ile Lys Ser Asn Glu Thr Ser Val
        355                 360                 365

Leu Gln Pro Leu Leu Gln Lys Phe Ile Asn Phe Ala His Ser Lys Val
    370                 375                 380

Arg Ala Ala Gly Leu Ser Pro Phe Val Trp Glu Glu Met Val Thr Thr
385                 390                 395                 400

Trp Asn Leu Thr Leu Gly Ser Asp Thr Val Val Gln Ser Trp Leu Gly
                405                 410                 415

Gly Asp Ala Val Lys Asn Leu Ala Glu Ser Gly His Lys Val Ile Asp
            420                 425                 430

Thr Asp Tyr Asn Phe Tyr Tyr Leu Asp Cys Gly Arg Gly Gln Trp Val
        435                 440                 445

Asn Phe Pro Pro Gly Asp Ser Tyr Asn Thr Tyr Tyr Pro Phe Asn Asp
    450                 455                 460

Trp Cys Gln Pro Thr Lys Asn Trp Arg Leu Ile Tyr Ser His Asp Pro
465                 470                 475                 480
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Ala Ala Asn Val Ser Ala Ser Ala Ala Lys Asn Val Leu Gly Gly Glu
                485                 490                 495

Leu Ala Ile Trp Ser Glu Met Ile Asp Ala Ser Asn Leu Asp Asn Ile
            500                 505                 510

Ile Trp Pro Arg Gly Ser Ala Ala Gly Glu Val Trp Trp Ser Gly Asn
        515                 520                 525

Thr Asp Ala Ser Gly Glu Gln Arg Ser Gln Leu Asp Val Val Pro Arg
    530                 535                 540

Leu Asn Glu Phe Arg Glu Arg Leu Leu Ala Arg Gly Val Ser Ala Phe
545                 550                 555                 560

Pro Ile Gln Met Thr Tyr Cys Thr Gln Leu Asn Ala Thr Ala Cys Thr
                565                 570                 575

Leu Phe
```

2) INFORMATION FOR SEQ ID NO: 11:

(i) SEQUENCE CHARACTERISTICS:

(A) LENGTH: 601 base pairs

(B) TYPE: amino acid

(D) TOPOLOGY: linear

(ii) MOLECULE TYPE: protein

(xi) SEQUENCE DESCRIPTION: SEQ ID NO: 11:

```
Met Phe Ser Arg Ala Ile Val Ala Ala Leu Ala Leu Ser Gly Pro Ala
  1               5                  10                  15

Phe Ala Leu Trp Pro Val Pro Lys His Ser Ser Thr Gly Asn Asp Thr
             20                  25                  30

Leu Phe Ile Asp Gln Thr Val Gln Val Thr Tyr Asn Gly Glu Gln Val
         35                  40                  45

Trp Trp Thr Pro Pro Tyr Asp Asp Pro Gly Ser Pro Asp Phe Ala Glu
     50                  55                  60

Thr Arg Ile Asp Asp Gln Gln Val Thr Tyr Thr Ala Gly Tyr Val Pro
 65                  70                  75                  80
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Pro Ser Gly Pro His Phe Thr Ser Lys Glu Ile Val Gln Gly Gly Val
                 85                  90                  95

Ser Arg Thr Phe Gly Ala Ile Phe Gln Gln Gly Phe Val Pro Trp Met
            100                 105                 110

Leu Arg Glu Arg Asp Ser Asn Ser Glu Pro Asn Leu Gly Gly Thr Arg
        115                 120                 125

Ile Arg Thr Leu Gln Ile Ile Gln Thr Gln His Asp Ser Ala Asn Thr
    130                 135                 140

Phe Lys Pro Leu Asn Gly Ala Val Asn Glu Ser Tyr Ala Leu Asp Val
145                 150                 155                 160

Asp Ala Lys Gly His Ala Ser Leu Thr Ala Pro Ser Ser Thr Gly Ile
                165                 170                 175

Leu Arg Gly Leu Glu Thr Phe Ser Gln Leu Phe Phe Lys His Ser Ser
            180                 185                 190

Gly Thr Ala Trp Tyr Thr Gln Leu Ala Pro Val Ser Ile Arg Asp Glu
        195                 200                 205

Pro Lys Tyr Pro His Arg Gly Leu Leu Leu Asp Val Ser Arg His Trp
    210                 215                 220

Phe Glu Val Ser Asp Ile Glu Arg Thr Ile Asp Ala Leu Ala Met Asn
225                 230                 235                 240

Lys Met Asn Val Leu His Leu His Ala Thr Asp Thr Gln Ser Trp Pro
                245                 250                 255

Leu Glu Ile Pro Ser Leu Pro Leu Leu Ala Glu Lys Gly Ala Tyr His
            260                 265                 270

Lys Gly Leu Ser Tyr Ser Pro Ser Asp Leu Ala Ser Ile Gln Glu Tyr
        275                 280                 285

Gly Val His Arg Gly Val Gln Val Ile Val Glu Ile Asp Met Pro Gly
    290                 295                 300
```

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His Val Gly Ile Asp Lys Ala Tyr Pro Gly Leu Ser Asn Ala Tyr Gly
305                 310                 315                 320

Val Asn Pro Trp Gln Trp Tyr Cys Ala Gln Pro Pro Cys Gly Ser Phe
                325                 330                 335

Lys Leu Asn Asn Thr Asp Val Glu Lys Phe Ile Asp Lys Leu Phe Glu
            340                 345                 350

Asp Leu Leu Pro Arg Leu Ser Pro Tyr Ser Ala Tyr Phe His Thr Gly
        355                 360                 365

Gly Asp Glu Tyr Lys Ala Asn Asn Ser Leu Leu Asp Pro Ala Leu Arg
    370                 375                 380

Thr Asn Asp Met Asn Thr Leu Gln Pro Met Leu Gln Arg Phe Leu Asp
385                 390                 395                 400

His Val His Gly Lys Val Arg Asp Leu Gly Leu Val Pro Met Val Trp
                405                 410                 415

Glu Glu Met Ile Leu Asp Trp Asn Ala Thr Leu Gly Lys Asp Val Val
            420                 425                 430

Ala Gln Thr Trp Leu Gly Gly Gly Ala Ile Gln Lys Leu Ala Gln Ala
        435                 440                 445

Gly Tyr Lys Val Ile Asp Ser Ser Asn Asp Phe Tyr Tyr Leu Asp Cys
    450                 455                 460

Gly Arg Gly Glu Trp Leu Asp Phe Ala Asn Gly Asp Pro Phe Asn Asn
465                 470                 475                 480

Asn Tyr Pro Phe Leu Asp Trp Cys Asp Pro Thr Lys Asn Trp Lys Leu
                485                 490                 495

Met Tyr Ser His Glu Pro Thr Asp Gly Val Ser Asp Asp Leu Lys Lys
            500                 505                 510

Asn Val Ile Gly Gly Glu Val Ala Val Trp Thr Glu Thr Ile Asp Pro
        515                 520                 525
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Thr Ser Leu Asp Ser Ile Ile Trp Pro Arg Ala Gly Ala Ala Ala Glu
    530                 535                 540

Ile Trp Trp Ser Gly Lys Ile Asp Glu Lys Gly Gln As Arg Ser Gln
545                 550                 555                 560

Ile Asp Ala Arg Pro Arg Leu Ser Glu Gln Arg Glu Arg Met Leu Ala
                565                 570                 575

Arg Gly Val Arg Gly Thr Pro Ile Thr Gln Leu Trp Cys Ser Gln Val
            580                 585                 590

Asp Val His As Cys Glu Ser Gly Asn
        595                 600
```

What is claimed is:

1. A laundry or cleaning product comprising one or more hexosaminidase enzymes.

2. A laundry or cleaning product according to Claim 1 wherein said hexosaminidase enzyme is selected from an enzyme which:

i) is encoded by a DNA sequence comprising or included in at least one of the sequences of SEQ ID Nos 6-9, or a sequence homologous thereto encoding a hexosaminidase polypeptide,

ii) is immunologically reactive with an antibody raised against a highly purified hexosaminidase encoded by the DNA sequence defined in i), and is specific for hexosaminidase,

iii) is immunologically reactive with an antibody raised against a highly purified hexosaminidase having SEQ ID Nos 1-5, 10 or 11, and is specific for hexosaminidase, or

iv) is a hexosaminidase having SEQ ID Nos 1-5, 10 or 11, or a hexosaminidase polypeptide sequence homologous thereto.

3. A laundry or cleaning product according to either of Claims 1 or 2 wherein said hexosaminidase enzymes are hexosaminidases having MIC for antimicrobial activity of less than 0.125%, more preferably less than 0.025%, and/or the ability to remove biofilm.

4. A laundry or cleaning product according to any of Claims 1-3 further comprising laundry or cleaning composition ingredients selected from the group consisting of detersive surfactants, detersive enzymes, builders, bleaching agents, and mixtures thereof.

5. A laundry or cleaning product according to any of Claims 1-4 wherein the detersive enzyme is selected from the group consisting of proteases, amylases, lipases, cellulases, and mixtures thereof.

6. A laundry or cleaning product according to any of Claims 1-5 wherein the builder is selected from the group consisting of zeolite, phosphate, and mixtures thereof.

7. A laundry or cleaning product according to any of Claims 1-6 wherein the bleaching agent is selected from the group consisting of perborate, percarbonate, and mixtures thereof, and preferably also comprising a bleach activator.

8. A laundry or cleaning product according to any of Claims 1-7 wherein the surfactant is selected from the group consisting of anionic surfactants, preferably alkyl sulfate and/or linear alkyl benzene sulfonate surfactants, cationic surfactants, nonionic surfactants, and mixtures thereof.

9. A method for laundering fabrics, said method comprising contacting fabrics in need of cleaning with an aqueous solution containing an effective amount of one or more hexosaminidase enzymes, preferably an aqueous solution of a composition according to any of Claims 1-8.

10. A method for cleaning dishes and tableware, said method comprising contacting dishes or tableware in need of cleaning with an aqueous solution containing an effective amount of one or more hexosaminidase enzymes, preferably an aqueous solution of a composition according to any of Claims 1-8.

11. A method for cleaning dishes and tableware according to Claim 12 wherein said method is carried out in an automatic dishwashing machine.

INTERNATIONAL SEARCH REPORT

Inte ional Application No
PCT/US 98/09125

A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 C11D3/386

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 6 C11D

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP 0 425 019 A (PROCTER & GAMBLE) 2 May 1991 see page 7, line 2 - line 45 see claims 1-6; example 5	1,3-9
X	DATABASE WPI Section Ch, Week 9320 Derwent Publications Ltd., London, GB; Class B04, AN 93-163586 XP002080339 & JP 05 095784 A (NAKANO VINEGARS DEALER KK), 20 April 1993 see abstract	1,3,9-11
A	WO 96 36700 A (NOVONORDISK AS) 21 November 1996 cited in the application see claims	1,2

☐ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

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"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
12 October 1998	22/10/1998

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INTERNATIONAL SEARCH REPORT

Information on patent family members

Int. ional Application No
PCT/US 98/09125

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